



THE CRIMESCENE

NEWSLETTER OF THE LAKE COUNTY CRIME LABORATORY

Dr. Karen Zavarella: A Fresh Face in DNA Analysis

Dr. Karen Zavarella is the newest scientist to join the Lake County Crime Laboratory (“LCCL”) team.

She earned her undergraduate degree in biology from the Catholic University of America. While there, she worked as an assistant in a cellular biology laboratory and gained valuable hands-on experience.

Dr. Zavarella then earned her doctorate and completed her research topic in molecular biology at the State University of New York at Buffalo, while teaching undergraduate classes in biology.

Her interest in forensics developed while in graduate school. Another graduate student was involved with forensic DNA analysis for the criminal justice system and told her about the new and quickly expanding field of forensic DNA profiling.

The topic piqued Dr. Zavarella’s interest. She joined the American Academy of Forensic Sciences and attended their annual meetings while still a graduate student. As tempting as it was to continue a career researching the molecular pathways of fruit flies’ eyes, she chose to go into forensics.

A Buffalo, NY, native, Dr. Zavarella has adopted the Cleveland area as her home. She moved after graduate school when she was hired ([CONTINUED ON PAGE 3](#))



Dr. Karen Zavarella



John Malko

Cold Case DNA

At 5 a.m. on June 11, 1995, a man broke into the home of a 57-year-old woman, raped her at knifepoint, and slashed her hand when she attempted to call for help.

For more than a decade, the rapist eluded justice; but he was eventually caught because of the commitment of the Willoughby Police Department and expertise of the Lake County Crime Laboratory.

Nowadays, it is easy to take the national DNA and large automated fingerprint databases—CODIS and AFIS, respectively—for granted. However, these databases were just beginning to be developed in 1995, as was the powerful forensic DNA technology that is now used in courtrooms every day. ([CONTINUED ON PAGE 5](#))

Frequently Asked Questions

This Column
Answers
Questions
Commonly
Asked of our
Scientists



ANSWERED BY SCIENTIST DAVE GREEN
EXPERT IN TRACE EVIDENCE EXAMINATION

Q: How does the Lake County Crime Laboratory use hair samples from the suspect and/or victim to perform DNA analysis on evidence? What's the difference between, and value of, nuclear DNA analysis, mitochondrial DNA analysis, and traditional microscopic hair comparisons? How should I collect known hair samples?

A: There are two types of DNA analysis that may be performed on hair evidence depending on the microscopic characteristics of the hair itself, mitochondrial DNA analysis and nuclear DNA analysis.

If microscopic examination of the hair reveals a suitable root, the LCCL can perform nuclear DNA analysis (STR DNA) on the hair. STR DNA analysis is very discriminating and is the same type of testing performed on nuclear cells present in blood, semen, or saliva. An STR DNA profile can provide definitive information regarding the source of the evidence hair, leading to a positive identification.

If the hair does not exhibit a root or if there are not enough cells for nuclear DNA analysis, then mitochondrial DNA (mtDNA) analysis can be performed.

mtDNA is found in organelles of the cells, which are only inherited along the maternal lines, so it is less discriminating than nuclear DNA. All individuals who have the same biological mother will have the same mtDNA profile.

mtDNA testing is conducted at the FBI lab without cost to the agency. There are rules for acceptance, and there may be a significant wait for the results. The LCCL conducts traditional microscopic hair analysis, which limits what hairs require mtDNA testing. This may expedite the acceptance and analysis by the FBI.

If the case does not meet the FBI's acceptance requirements, there are private DNA laboratories that conduct mtDNA analysis quickly. They are expensive but still a viable option, depending on the circumstances of the case and the evidentiary value of the hair.

Traditional microscopic hair comparison, as performed by the LCCL, compares a questioned hair to known hair from a victim and/or suspect. Although the results of a positive microscopic hair comparison cannot exclude all other individuals and does not have the statistical significance of a DNA match, it can often eliminate subjects who were thought to be sources of the hair.

In other words, microscopic hair comparison cannot always tell us who the exact person was who left the hair. However it can often tell us who did not, which can be very helpful to law enforcement agencies during an investigation.



Suitable for STR DNA analysis

Suitable for mtDNA analysis

Although many laboratories in Ohio no longer have scientists available to conduct traditional microscopic hair comparisons, the LCCL still provides this valuable service.

If the LCCL requests that you collect a known hair sample, then pluck—do not cut—the hairs. Collect 10 to 20 hairs from the right side of the head, 10 to 20 hairs from the left side, 10 to 20 from the back and another 10 to 20 from the front.

Place each hair sampling into a folded piece of paper, write the scalp location on the paper, and seal all samplings in one envelope. Label the sealed envelope with the donor's name, collector's name and the date.

Law enforcement personnel with questions about hair comparison or other trace evidence, can contact David Green, Trace Evidence Examiner, at 440-350-2793 or dgreen@lakecountyohio.gov.

For questions about DNA analysis, contact Linda M. Erdei, MS, Laboratory Director/DNA Technical Manager at 440-350-2793 or lerdei@lakecountyohio.gov. 🐾

HIGHLIGHTS

- Degree in Biology from The Catholic University of America (1992)
- Ph.D. in Molecular Biology from the State University of New York at Buffalo (1998)
- Trained at the Miami-Dade Police Department Safety Training Institute in the area of Bloodstain Pattern Analysis
- Guest Lecturer at Case Western Reserve University School of Law and State University of New York at Buffalo

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by the Cleveland Police Forensics Laboratory as a Scientific Examiner.

While with the Cleveland Police, Dr. Zavarella's primary duties were in the Serology and DNA sections of the laboratory. She also cross-trained in the drug chemistry and crime scene departments.

At her first crime scene, Dr. Zavarella had the prestigious duty of scraping brains from the ceiling of a local store. Even though the store was involved in an attempted robbery, the patrons were annoyed that she interrupted their shopping just because brain matter was hanging above the counter.

Forensics has been her passion ever since.

She was not deterred by her first visit to the morgue even though it

happened to be a particularly gruesome day—even by the standards of a morgue. Each gurney held a story sadder than the next.

The first gurney held a man whose head was “relocated”—cradled at his side by his arm. He was an apparent victim of falling asleep on the train tracks.

The second body was that of a youth who had accidentally been shot by a friend while playing roulette with a revolver; and the third body was a baby, smothered by his mother.

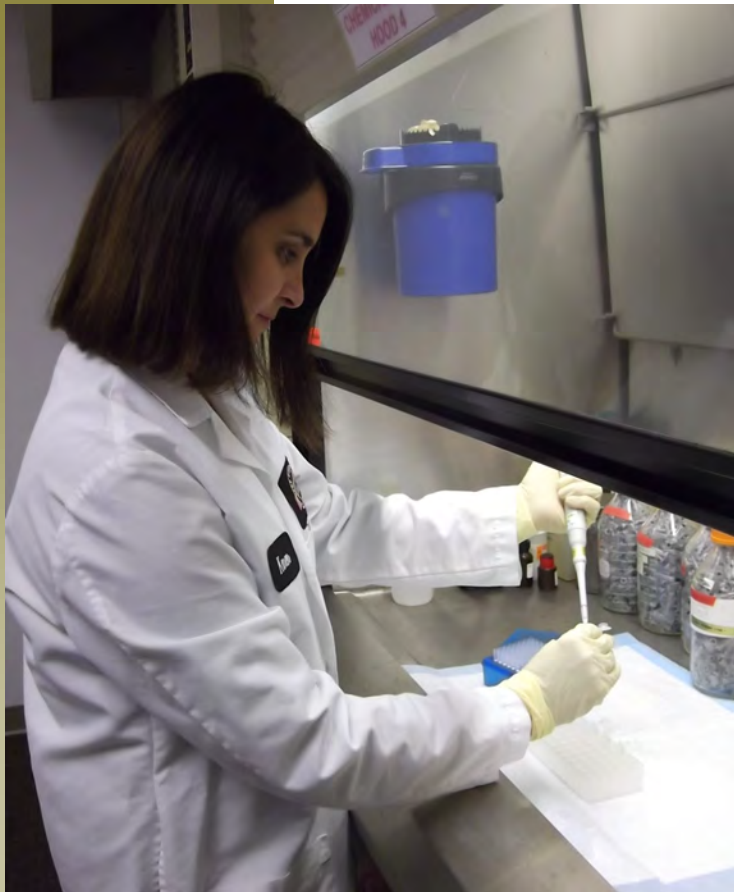
Seeing those bodies, Dr. Zavarella felt gut-wrenching sadness. But she also felt a fierce determination to make a career where she could help those who suffer and alleviate their pain.

After a few years with the Cleveland Police, Dr. Zavarella took a leave of absence from the field of forensics to start a family. In five years, she had five sons—all of whom make her very proud!

She was still able to put her skills and experience to use as a mom, examining “crime scenes” and “biological fluids.” The case of the 40-pound bag of dog food and the washing machine proved to be especially difficult. (It was the two oldest sons. They perpetrated the crime while Dr. Zavarella was busy feeding their younger brother.)

After several years of being lead investigator at home, she wished to return to the field of forensics and joined the Lake County Crime Laboratory as a DNA Analyst in the fall of 2012.

Her skills have expanded to include crime scene analysis, bloodstain pattern interpretation, and analysis of [\(CONTINUED ON PAGE 4\)](#)



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controlled substances.

Her new job has exposed Dr. Zavarella to a plethora of circumstances and evidence that require creative and unconventional thinking when it comes to examination and collection.

For example, Dr. Zavarella and the Lake County Crime Laboratory are fully involved with an emerging type of DNA profiling called “touch” DNA. Typically, most DNA evidence originates from a biological fluid (blood, saliva, semen, and urine), body tissue, bones, hair, or teeth.

“Touch” DNA analysis is simply this: analyzing samples containing skin cells rather than a standard biological fluid. The state-of-the-art technique used to analyze DNA is extremely sensitive, which increases the LCCL’s ability to get information from an object that has been handled by an individual during a crime.

The laboratory’s success in this area has helped to solve a number of nonviolent crimes, such as burglaries. This takes criminals off the street before they progress to more violent crimes.

Furthermore, many of the DNA profiles generated are eligible for input into the DNA database (Combined DNA Index System or CODIS.) Once entered, their profiles can be searched against the profiles submitted by numerous agencies throughout the United States.

This enables “cross talk” between laboratories, which helps to link individuals to crimes or to identify patterns involving several crimes.

Dr. Zavarella works diligently to ensure that all items of evidence are examined to the fullest extent.

Additionally, her experience in a larger laboratory did not allow for personal contact with the individual officers involved in investigations, so she now enjoys and welcomes the opportunity to work directly with law enforcement personnel.

Dr. Zavarella is enthusiastic about her position at the LCCL and looks forward to providing local law enforcement, attorneys, juries, and judges with the scientific facts that are a crucial part of a criminal investigation. 🍩



LAW ENFORCEMENT OFFICERS WHEN IN THE AREA

BAGELS ARE ON US!

Want to meet Dr. Zavarella or any of the LCCL scientists in person? Have a question for a scientist that you would like to discuss in person? Want to see the new layout of the LCCL?

The scientists of the LCCL are always willing to meet with law enforcement personnel to discuss any issue or question that you may have, but as an added bonus on Fridays, the LCCL has donuts, bagels, and coffee to help facilitate discussion between officers and scientists. Feel free to stop by!

Exciting New Instrumentation!

The Lake County Crime Laboratory is purchasing a forensic 3-D laser scanning system for crime scene documentation and reconstruction.

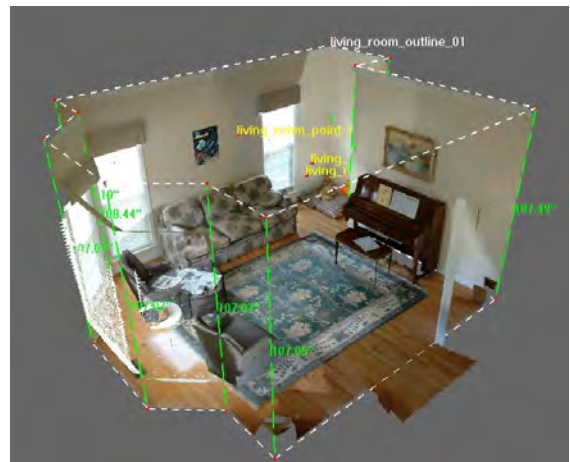
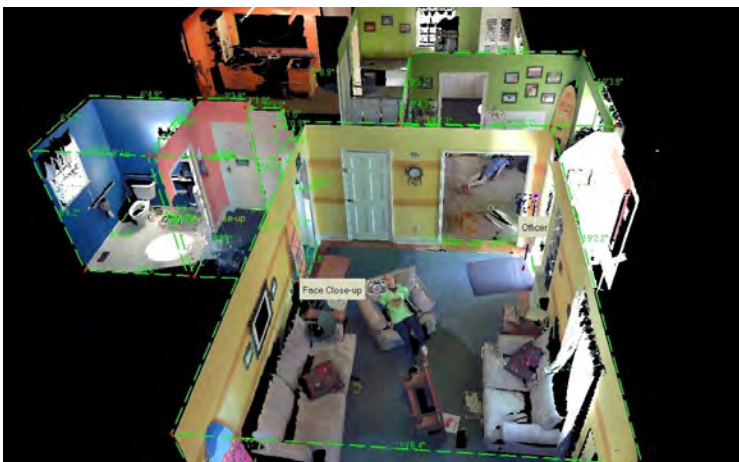
This cutting edge technology is built around a Focus3D Laser Scanner. This scanner scans 360 degrees in a matter of minutes, in the process taking millions of measurements. This hardware is then combined with SceneVision-3D Software to deliver amazing results:

- Crime scenes are completely and accurately captured, and once scanned, any specific measurement can be determined from the collected data;
- The software allows for reconstruction of incidents, including shooting trajectories, bloodstain pattern analysis, and the determination of victim locations;
- The system allows for complete and unaltered views of crime scenes, and three dimensional models can be created and viewed from any direction.

The Lake County Crime Laboratory will soon have this new equipment up and running, and it will be available whenever needed by the Lake County Law Enforcement Community. 📍



Focus3D Laser Scanner



Did You Know?

The highest quality and professional standards; assistance whenever it is needed; services that are not offered by other laboratories—that's what the Lake County Crime Laboratory offers local law enforcement.

The LCCL is an elite, full-service forensic laboratory that serves the needs of all Lake County's criminal justice agencies and provides the newest technology with which to protect families and businesses in the event of a crime.

The dedicated scientists are highly trained, skilled in their respective fields, and on-call at all times to offer their assistance and advice at crime scenes. They process evidence with the highest level of commitment and thoroughness to support local law enforcement with their cases and help bring criminals to justice.

The LCCL goes above and beyond in all fields and, in many areas, offers services that are not available elsewhere.

In its DNA Section, the LCCL's technology is state-of-the-art. Moreover, it places no limit on the number of samples that can be tested, and all cases are examined to the fullest extent. Also, the LCCL performs touch DNA analysis on all types of crimes—both violent and property crimes—as opposed to other laboratories, which only perform touch DNA analysis on violent crimes.

In the Trace Section, the LCCL offers microscopic hair-comparison analysis, as well as fire-debris and explosive-residue analysis, which are not offered at most laboratories.

The Controlled Substances Section provides a level of investigation not equaled by any other forensic laboratory in the state. All drugs are investigated beyond the typical standard of “up to charge” as the LCCL performs a full analysis on each and every item, including syringes and drug paraphernalia.

When investigating clandestine drug laboratories, LCCL scientists also determine the precursor drugs



and final products made in the laboratory, if possible. And, in the analysis of bulk quantities of tablets, all other crime laboratories in the state only analyze a certain percentage of tablets, but the LCCL will analyze all tablets up to the highest bulk amount.

The Controlled Substances Section also investigates all unknown substances, including potential poisons, to the fullest extent and does not simply report them as “no controlled substance.”

The LCCL offers toxicology testing, which is not provided by the other laboratory systems. Lake County's Forensic Toxicologist, Douglas Rohde, M.S., regularly provides impairment testimony and opinions for Lake County and counties throughout the state.

Also, the Crime Scene Investigation Unit brings scientists to the crime scene to offer their expert advice and assistance to the lead investigators.

All scientists at the LCCL are on hand for any and all questions law enforcement personnel may have, 24 hours a day, 7 days a week.

The LCCL offers law enforcement the unique ability to connect with scientists who maintain the highest quality and professional standards—which, in turn, helps them protect Lake County residents and businesses. ➔

LCCL DOES IT

**DNA • Firearms • Fingerprints • Digital Evidence
Trace Evidence • Toxicology • Controlled Substances
Crime Scene Analysis**



LAKE COUNTY CRIME LABORATORY

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An ASCLD/LAB-International Accredited Laboratory since 2009

An ASCLD/LAB-Legacy Accredited Laboratory 2000-2009

NEW TESTING: JTAG Cell Phone Examinations

The Lake County Crime Laboratory now has a new, more advanced mobile device technique available to assist in examining mobile devices, such as cell phones that are passcode locked, damaged, or not supported using conventional forensic examination tools.

JTAG stands for Joint Test Action Group. JTAG is a method of testing printed circuit boards during manufacturing. It is used in mobile forensics as a method to dump the raw memory from the mobile device. The memory dump is then analyzed using conventional forensic tools.

To use the JTAG method, the mobile device is disassembled to expose the JTAG test points. A phone flasher box is connected by soldering small wires to the JTAG test points. The flasher box is controlled by a computer, and the memory dump is copied over to the computer for later analysis. This new method of examination should help to provide better results from mobile devices. 🐼

The CRIMESCENE

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JTAG hardware hooked into a cell phone circuit board