

Approximately 40 officers from half a dozen Kentucky law enforcement agencies sat together in a classroom in the basement of a building on the University of Louisville's Shelby Campus and conferred about how they should respond to and investigate a troubling series of events.

During a two-week period, scores of people in a Kentucky community had fallen ill with an undiagnosed infection of unknown origin that caused fever, pneumonia and liver damage. Amid a local and national political climate charged with concern over the threat of terrorism, the circumstances surrounding the disease outbreak had begun to seem suspicious. But when local, state and federal public health authorities recognized unusual patterns in the occurrence of the mysterious illness across the community, those circumstances took on positively sinister implications. Based on the geographic distribution of the residences of those who had fallen ill, as well as other evidence from their investigation, health officials feared that people had been deliberately sickened by the intentional release of a biological agent.

This raised a number of difficult and unfamiliar questions for the Kentucky law enforcement officials gathered in that room. What was the best way to coordinate the public health and criminal investigations? How could information from the public health investigation be used as evidence to help discover, apprehend and eventually convict any criminal suspects? Who was available and qualified to operate in an environment that was both a potential crime scene and a hazardous materials incident or to process materials that could be both evidence and bio-hazardous?

Fortunately, the officers were not confronted with an actual instance of bioterrorism. They were participating in a training scenario that was part of a forensic epidemiology course sponsored by the Department of Criminal Justice Training. The course, officially titled Law Enforcement Response to Public Health Emergencies, was developed jointly by the Kentucky Department for Public Health and the Louisville Metro Department of Public Health and Wellness and is taught by public health professionals from the Kentucky Department for Public Health and local health departments throughout the state. The course was first offered in March at the Elizabethtown Police Department, and additional sessions will be offered at least through the end of the year. The goal of this course is to enhance the joint effectiveness of law enforcement and public health in conducting investigations of health problems associated with criminal acts or intent, or of crimes having public health consequences.

Forensic epidemiology is an unfamiliar term to most people in the law enforcement community, and defining the concept is not simple. While everyone in law enforcement understands the term forensic to mean "relating to the in- >>

FORENSIC EPIDEMIOLOGY:

Kentucky law enforcement officers train to investigate bioterrorism / Matthew Groenewold, MSPH
Louisville Metro Department of Public Health and Wellness

>> vestigation and establishment of facts or evidence suitable for use in a court of law,” the term epidemiology, referring to the public health discipline that studies the amount, causes and spread of diseases in populations, is much less familiar to those without considerable exposure to the public health or medical fields. Simply defining its component parts, however, does not convey all of the term’s different connotations, which can vary depending on the context in which it is used.

Forensic epidemiology is most commonly understood to refer to that area of practice where public health and criminal investigations overlap, especially as it relates to possible instances of bioterrorism (1). But this was not always the case. Over the course of the past three or four decades, there have been numerous examples of either parallel or joint investigations conducted by law enforcement and public health authorities into either health problems that were suspected to have been intentionally caused or crimes that had potentially significant public health consequences (1). These included investigations into the Atlanta child murders (2), a number of so-called angel of death scenarios in which nurses or other healthcare providers in hospitals and nursing homes were found to have intentionally administered le-

by such a witness is often required when a judge or jury must determine whether a particular exposure (to an environmental chemical contaminant, for example, or repetitively performed task) is related to a particular injury (a birth defect, for example, or carpal tunnel syndrome). Forensic epidemiologists have become regular fixtures in toxic tort cases, in which injuries or diseases are claimed to have resulted from exposure to an environmental toxin.

Around 1999, the term became associated with the threat of bioterrorism. The first use of the term in this context may have been by the former chief deputy of the Union of Soviet Socialist Republic’s bio-weapons program. Dr. Ken Alibek used the term to describe activities that would help distinguish natural from man-made epidemics (1). A few months after the September and October 2001 Anthrax attacks, Dr. Julie Gerberding – then a senior official with the Center for Disease Control’s National Center for Infectious Diseases, now the director of the CDC – used the term when describing the need for the CDC’s Epidemic Intelligence Service epidemiologists to be trained to respond to bioterror attacks as well as other public health emergencies (1).

Today, while epidemiologists continue to testify

“Forensic epidemiology is most commonly understood to refer to that area of practice where public health and criminal investigations overlap, especially as it relates to possible instances of bioterrorism.”

thal doses of unprescribed medications (3-7), and intentionally caused outbreaks of foodborne illness (8, 9). An example of the latter category is the 1984 case of intentional contamination of restaurant salad bars in The Dalles, Oregon with the bacterium *Salmonella typhimurium*, an instance of domestic bioterrorism carried out by religious followers of the Indian guru Bhagwan Shree Rajneesh (8). In their time, however, none of these investigations was thought of as an example of forensic epidemiology.

Until about eight years ago, the term forensic epidemiology was typically used to refer to the presentation of an epidemiologist as an expert witness, most often in civil proceedings (1, 10). Testimony

as expert witnesses in both civil and criminal court proceedings, the connotation of the term forensic epidemiology has shifted decisively in favor of the criminal/bioterrorism context. In consideration of this shift, a formal definition for forensic epidemiology was proposed in 2003:

- The use of epidemiologic methods as part of an ongoing investigation of a health problem for which there is suspicion or evidence regarding possible intentional acts or criminal behavior as factors contributing to the health problem, or
- The use of epidemiologic and other public health methods in conjunction with or as an adjunct to an ongoing criminal investigation. [1]



Additionally, the American Academy of Microbiology has proposed the following definition for the separate and more specific, but nevertheless related, field of Microbial Forensics:

- The emerging discipline of microbial forensics combines principles of public health epidemiology and law enforcement to identify patterns in a disease outbreak, determine the pathogen involved, control its spread and trace the micro-organism to its source – the perpetrator(s) (11).

The need for law enforcement and public health to work closely together and to be able to conduct effective joint investigations was dramatically underscored by the events of September and October 2001. As a result, a number of joint law enforcement/public health training programs have since been developed and implemented across the country. The prototypical joint training program of this type, titled “Forensic Epidemiology: Joint Training for Law Enforcement and Public Health Officials on Investigative Responses to Bioterrorism,” was developed by the CDC in 2002 and released nationwide in 2003 (12). Now, virtually all training billed as forensic epidemiology training, whether conducted by law enforcement or public health agencies, focuses on the response to and investigation of instances of bioterrorism (1).

The course offered in Kentucky is, in some ways, based on the CDC course and its related reference guide produced jointly by the

CDC and the FBI, the “Criminal and Epidemiological Investigation Handbook,” (13) but with one important difference. While the CDC course is intended to be a truly joint training in which law enforcement and public health officials are trained together, the Kentucky DOJCT course is designed specifically for law enforcement officers. The aim of the course is to enhance the ability of law enforcement officers to operate closely and more effectively with public health officials when they investigate public health problems that may have been intentionally caused or crimes that have public health consequences. It attempts to accomplish this by familiarizing officers with the basic principles of public health and the epidemiological approach to investigations. Also, the course introduces them to some of the difficult issues that are likely to arise and needs to be resolved in the course of a joint criminal/epidemiological investigation.

The eight-hour course makes use of both lectures and interactive, facilitated group discussions of both factual and hypothetical scenarios. These discussions reinforce the content of the lectures by giving the participants an opportunity to apply the concepts and principles they have learned to actual and hypothetical epidemiological investigations.

While the course focuses primarily on bioterrorism, such incidents are not the only instances where the principles of forensic epidemiology might be applied. Public health and law enforcement may also be required to work together to detect, respond to and investigate inten-

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tionally caused problems that impact public health, which result from non-terrorist acts that violate other criminal statutes, state or federal. An example of this type of crime, which might be investigated using the principles of forensic epidemiology, is of environmental crimes, such as improper disposal of hazardous waste that results or threatens to result in human illness or injury. Such environmental crimes may involve violations of state or federal law, or both. Criminal negligence on the part of corporations or other parties that results in consumer injury or illness might also be jointly investigated by law enforcement and public health. Imagine, for example, a food processing plant that intentionally bypassed food safety procedures to save money and distributed contaminated products, resulting in a food-borne disease outbreak. Or imagine an auto mechanic shop that, with the intention of increasing profit, knowingly performs shoddy repairs or uses faulty parts, resulting in an increased risk of motor vehicle crashes. Investigation of these sorts of crimes might require joint public health and law enforcement operations without federal involvement, in contrast to investigations of terrorist acts, which always fall under federal jurisdiction.

Forensic epidemiology represents the intersection of criminal and epidemiological investigations, so the course focuses on the investigative aspects of joint law enforcement/public health operations and is well suited for detectives, criminal investigators or other officers with investigative responsibilities. However, forensic epidemiology, or joint investigations, is not the only context in which law enforcement and public health might officially interact, especially during emergencies. For example, public health officials might request assistance from police in enforcing isolation and quarantine orders. Occasionally, people with active tuberculosis, particularly the multi- or extensively drug-resistant forms, who do not comply with court-ordered treatment regimens must be detained in prison until their antibiotic therapy is complete. During an epidemic or pandemic that results in significant public panic, law enforcement may be called upon to enforce public order or even enforce compliance with stringent public hygiene measures put in place by the health department. Law enforcement may also be needed to protect critical medical or public health infrastructure such as hospitals, points of distribution or stores of medical supplies during an epidemic.

One of the byproducts of the forensic epidemiology class has been recognition on the part of DOCJT and its public health partners of the need for formal training in these other, non-investigative areas of law enforcement/public health interaction. DOCJT, the state Department for Public Health and the Louisville Metro Department of Public Health and Wellness are planning to develop a course to be offered in 2008 addressing these areas and specifically target officers whose primary responsibilities do not include criminal investigation. DOCJT also plans to offer the forensic epidemiology course for detectives, investigators and command staff in 2008.

DOCJT, the state Department for Public Health and the Louisville Metro Department of Public Health and Wellness are collaborating as part of their commitment to the safety, health and well being of all citizens of the commonwealth. For more information about forensic

epidemiology or other joint law enforcement/public health training opportunities, contact DOCJT, the state Department for Public Health's Preparedness Branch or the Louisville Metro Department of Public Health and Wellness' Office of Emergency and Public Health Preparedness. J

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DOCJT Launches First Criminalistics Academy in Kentucky

Agency accepting applications for next course / Jamie Neal-Ball, Public Information Officer

Kentucky crime scene investigators now have the opportunity to attend the first criminalistics academy in the commonwealth.

The Department of Criminal Justice Training has developed the Kentucky Criminalistics Academy, an intensive, 10-week course for full-time crime-scene investigators, newly appointed crime-scene investigators and patrol officers who also serve as crime-scene investigators for their agencies. The academy is open to civilian CSIs who work for Kentucky law enforcement agencies.

At the KCA, which is located at DOCJT in Richmond, students will be trained with the most recent crime-scene investigation techniques and technology available. The academy is designed to meet Kentucky law enforcement's needs in evidence identification, collection and preservation.

Graduates will possess the knowledge to respond to and assist with investigations into any criminal activity, including those involving terrorism, as well as natural disasters that include mass casualties.

Twelve students from across the state have been selected for the first academy, which is scheduled for September 10 through November 16.

"This academy offers a very high level of training for crime scene investigators, and now their agencies don't have to send them out of the state or spend much money to get it," said Frank Kubala, DOCJT Investigation Section supervisor.

DOCJT has provided some training in the past

that is now included in the KCA, such as bloodstain pattern recognition, but the academy offers much more – including a week at the Body Farm (formally the Anthropological Research Facility) at the University of Tennessee.

"This is way beyond anything that we're doing right now," KCA coordinator and DOCJT instructor, Joe Wallace, said prior to the KCA opening.

Students will be given written and practical exams in various topics and will have the opportunity to become certified in many areas, including marijuana identification. Some of the certifications will meet the requirements of the International Association for Identification and the International Association of Bloodstain Pattern Analysts toward some of their certifications, Kubala said.

The next KCA is set to begin in July 2008.

DOCJT picked the agencies that are represented in the first KCA course, but the agency will accept applications from CSIs who

want to participate in the July 2008 academy. The course will be included in the class schedule book that agencies will receive in November.

To be considered for the academy, an applicant must be a full-time crime-scene investigator, newly appointed crime-scene investigator or patrol officer who also serves as a crime-scene investigator. Applicants must also be computer literate, prepared to participate in group activities and prepared to work outdoors with human cadavers.

For more information about the KCA, contact DOCJT's Wallace at (859) 622-6485. J



KCA training modules include:

- Alternate light sources and luminol
- Arson
- Bloodstain pattern recognition
- Bullet trajectory and shooting reconstruction
- Body Farm – includes lectures and field exercises in osteology, entomology, collecting surface skeletons and probing for buried bodies
- Computer and digital evidence
- Crime-scene management
- Computer Aided Drawing (crime-scene sketching, mapping and documentation using Total Station Crimes program)
- Techniques in case preparation and court presentation
- Death investigation – autopsy, postmortem fingerprinting and wound analysis
- Digital photography
- DNA
- Explosives investigations
- Latent-fingerprint processing
- Marijuana identification
- Trace evidence

When the Kentucky State Police was formed in 1948, its first commissioner, Guthrie Crowe, set out to make it a modern, scientific, crime-fighting organization.

One of his first moves was to acquire a \$1,200 comparison microscope with a camera mounted on top to assist in examining bullets and cartridge cases. Fred Watson, a young chemical engineering graduate from the University of Louisville, was hired and given an annual budget of \$600 to set up a crime lab. He was given two weeks of training in chemical testing, blood analysis, firearms identification and photomicrography at the Indiana State Police Criminal Investigations Lab in Indianapolis.

On May 15, 1951, the new lab formally opened with a public announcement that its services would be available to any city, county or other local police officer in the commonwealth. Operations were sparse at first.

"They didn't have much more than a microscope, a bottle of distilled water and an empty room," said Lt. Spercel Fayne, director of the lab's photography section at the time.

Cheap perfume bottles were scrounged for use as reagent atomizers, and the lab became known as the wrapping room, a place where evidence was often simply repackaged for shipment to the FBI in Washington.

Fifty-five years later, the state police crime lab has grown from a one-man show to a regional system of six labs with more than 86,000 square-feet of space and 136 employees. In 2006, the labs processed evidence from more than 46,000 cases involving arson, biology, firearms, gunshot residue, solid dose drugs, toxicology, trace, and forensic video and photography.

Under the command of Maj. Wayne Mayfield, a 33-year KSP veteran, the state police lab system continues its heritage of supporting law enforcement agencies throughout Kentucky.

"Our mission is to provide objective interpretations supported by validated science complemented by expert testimony," Mayfield said.

To accomplish this task, Mayfield leads a force of specialists with job titles such as forensic chemist, forensic biologist, forensic scientist specialist, firearms/toolmark examiner, breath alcohol technician, police polygrapher and forensic photographer, to name a few. They operate a variety of high-tech equipment with ominous sounding names such as gas and ion chromatographs, mass spectrometers, scanning electron microscopes, microspectrometers and genetic analyzers.

All this sophisticated technology and expertise is employed to examine and analyze materials such as paint, hair, glass, soil, cloth- >>

◀ Forensic biologist Brittany Ross prepares blood samples for DNA typing. Ross works out of the Central Forensic Lab in Frankfort.

Forensic Justice

Kentucky State Police Lab System is a valuable resource for law enforcement agencies throughout the state / Les Williams, Public Information Officer, Kentucky State Police

/Photo KSP submitted



Photo KSP submitted

▲ Forensic photographer Charity Hedges prepares a close-up photograph of a handgun for use in court.

ing, explosive debris and all types of body fluids including blood, semen, saliva, urine and sweat. The objective is always the same: identification and interpretation of evidence that will make a difference in solving a case.

“This may sound like glamorous work, using science and technology to catch criminals, but it often involves slow, tedious, detail work with undesirable materials,” Mayfield said. “It’s really a tribute to the dedication of our lab personnel that they achieve continual success when working with such material day in and day out.”

It is important to note that work done in the laboratory not only works for the prosecution, but for the defense. Objective interpretation can prove innocence.

Despite all the technology, it’s the lab’s people that often make all the difference, Mayfield said.

“Our lab personnel do a very good job with limited resources but they can’t work miracles,” he said. “They work best when there is ongoing, two-way communication between them and the investigator.”

A promising new tool to aid in this communication process was initiated in June of this year. KSP’s six lab branches are now linked by a state-of-the-art Labora-

tory Information Management System, which is a virtually paperless, online operation that streamlines evidence handling and processing. It enables administrative and technical reviews to be handled remotely, and evidence to be bar coded at intake for ease of tracking and accountability. Police and prosecutors will soon have access to lab reports through a remote log-in.

“Evidence audits are now less time consuming and accountability is enhanced,” Mayfield said.

Although most of their work is performed in the lab, KSP analysts also provide another vital service – expert testimony in the courtroom. Analyst must successfully complete a mock trial during their initial training, and their actual courtroom testimony is evaluated by prosecutors and/or supervisory staff on a yearly basis. Toxicology and drug chemists often appear in court three or four times a month. Trace chemists, firearms examiners and forensic biologists testify about once a month.

“This ability to personally speak in the courtroom provides an additional dimension to the services we provide,” Mayfield said. “It also gives the prosecution a tool with added impact and credibility.”

KSP Laboratory Branches

CENTRAL LAB

100 Sower Blvd., Suite 102
Frankfort, KY 40601
Telephone: (502) 564-5230 or 1
(800) 326-4879
Fax: (502) 564-4821

Services provided:

- Toxicology
- Breath alcohol maintenance
- Solid dose drugs
- Blood alcohol
- Trace/GSR/arson
- Firearms/Toolmarks/Imprint evidence
- DNA casework
- DNA database
- Photo
- Polygraph
- Forensic video analysis

WESTERN LAB

1081 Thornberry Drive
Martin Plaza Mall
Madisonville, KY 42431
Telephone: (270) 824-7540
Fax: (270) 824-7029

Services provided:

- Breath alcohol maintenance

- Blood alcohol
- Solid dose drugs
- Forensic biology casework screening
- Polygraph

JEFFERSON LAB

3600 Chamberlain Lane, Suite 410
Louisville, KY 40241
Telephone: (502) 426-8240
Fax: (502) 426-4531

Services provided:

- Blood alcohol
- Solid dose drugs
- Forensic biology casework screening
- Firearm/Toolmark/Imprint evidence

NORTHERN LAB

5690 East Alexandria
Cold Springs, KY 41076-9734
Telephone: (859) 441-2220
Fax: (859) 441-0848

Services provided:

- Breath alcohol maintenance
- Blood alcohol

- Solid dose drugs
- Forensic biology casework screening
- Polygraph

EASTERN LAB

1550 Wollohan Drive, Suite #2
Ashland, KY 41101
Telephone: (606) 929-9142
Fax: (606) 929-9364

Services provided:

- Breath alcohol maintenance
- Blood alcohol
- Solid dose drugs
- Firearms/Toolmarks/Imprint evidence

SOUTHEASTERN LAB

1001 West 5th Street
London, KY 40743
Telephone: (606) 877-1464
Fax: (606) 878-0643

Services provided:

- Breath alcohol maintenance
- Blood alcohol
- Solid dose drugs
- Firearm/Toolmark/Imprint evidence
- Polygraph ■

Establishing and maintaining credibility is of vital importance to the effectiveness of a crime lab, and the KSP lab goes to great lengths to achieve it. Mayfield points with pride to the three KSP lab branches (Central, Jefferson and Northern) that achieved accreditation with the American Society of Crime Lab Directors Laboratory Accreditation Board in 2005.

On an individual level, many KSP lab personnel maintain membership in organizations such as the Association of Firearms/Toolmark Examiners, the Society of Forensic Toxicologists, the Southern Association of Forensic Scientists, the American Polygraph Association, the International Association for Identification and the International Association of Bloodstain Pattern Analysts.

“This is a true testament to the high level of dedication and commitment of our staff and their understanding of the stringent standards and requirements of their work,” Mayfield said.

Hard work in the laboratory can lead to tremendous benefits for law

enforcement and the citizens of Kentucky. In the fall of 2006, several central Kentucky cold cases were linked and two serial criminals identified through DNA. One of the individuals was linked to four unsolved sexual assaults that dated from the early 1990s and the second to several unsolved homicides. Both are awaiting trial and several cold cases are now solved, bringing some degree of closure to several victims and families.

With successes like these and many others, the KSP Crime Lab system is a valuable resource that law enforcement agencies throughout the state can’t afford to ignore, Mayfield said.

“However, it takes a two-way partnership to make it work smoothly,” he said. “Don’t wait until the last minute to submit evidence. Field personnel must collect evidence properly and submit it in a timely manner for us to do our job. The result will be a win-win situation for everyone involved.” J