The FBI Laboratory: 75 Years of Forensic Science

Part 3 Questions:

1. Starting in 1933 through today, what methods have been developed by the FBI for collecting fingerprint evidence?

2. Describe 3 ways in which the FBI and specific groups within it assisted in the investigation and recovery response to the bridge collapse in Minneapolis.

3. What is the ILEA and what is the goal of this agency?

4. What 3 items from the assassination of Abraham Lincoln have been examined and authenticated by the FBI Laboratory?

5. In comparison to when the FBI Laboratory opened, how many pieces of forensic evidence are processed each year?
Fingerprints

Perhaps no other discipline is associated more with the FBI than fingerprints. In 1924, the fingerprint records of the National Bureau of Criminal Identification and Leavenworth Penitentiary were combined to form the National Division of Identification and Information, under the jurisdiction of the Bureau of Investigation. At its inception, the fingerprint file comprised 810,188 records, and by mid-1932, the number of records exceeded 3.5 million.

Although the FBI Laboratory does not manage the FBI’s fingerprint files, the Laboratory has always had a crucial role in fingerprint analysis. Early on, the Bureau realized that latent prints recovered at crime scenes could not be searched manually against the large repository of records it held. At the same time, the value of latent fingerprints in solving cases was clear. By 1933, the Bureau had created two new fingerprint files: the Single Fingerprint File, which contained the fingerprints of known criminals who had committed serious crimes, and the Unidentified Latent Print File. These files were placed under the authority of a new section, the Single Fingerprint Section, which was established in the new Technical Laboratory. In 1936, the section was moved to the Identification Division. The name was changed to the Latent Print Section in 1950, and the section was reassigned to the Laboratory in 1992.

Regardless of its place in the FBI’s organizational structure, the Latent Fingerprint Section became known for studying the science behind fingerprint identification. Personnel researched new methods of developing, comparing, and identifying latent prints and taught these methods to FBI and police personnel around the world. Applying new techniques and computer automation to fingerprint identification became essential as both the number of fingerprints on file and the number of cases submitted to the FBI exploded.

As early as 1933, latent print examiners discovered that a silver nitrate solution could be used to develop prints on paper and other porous surfaces when the traditional iodine-fuming method proved unsuitable. In 1954, examiners studied and consequently implemented the use of ninhydrin to develop prints on porous surfaces. In the late 1970s, they tested and began using lasers to detect latent prints. In more recent years, new techniques have included the use of cyanoacrylate (superglue), fluorescent powders and dyes, and alternate light sources.

Much of the Latent Print Units’ research efforts depend on remaining alert to new methods as well as establishing partnerships with other organizations. For example, FBI Laboratory examiners work with the Forensic Anthropology Center at the University of Tennessee at Knoxville, better known as the Body Farm, to develop latent prints from human remains under varying conditions and degrees of decomposition.

After latent prints are developed and photographed, examiners compare them with the millions of fingerprint records in the Integrated Automated Fingerprint Identification System (IAFIS), an electronic network of databases housed at the FBI’s Criminal Justice Information Services Division, in Clarksburg, West Virginia. Doing so allows examiners to possibly match latent prints to the known prints of individuals already contained in the system. This massive task could never be completed by manually searching fingerprint records. In 2005, IAFIS processed its 100 millionth print.

The Disaster Squad

In August 1940 during a violent storm, an airliner crashed in a cornfield near Lovettsville, Virginia. An FBI agent on his first assignment, an FBI stenographer on vacation, and a Department of Justice official were
among those killed in the crash. FBI agents and fingerprint experts from the Single Fingerprint Section rushed to the crash site to identify the FBI and DOJ personnel. Local authorities requested the FBI’s help in identifying the rest of the victims, whose remains were strewn across the large crash site. FBI personnel eventually recovered and identified the bodies of all 25 crash victims. This operation identified the need for a team of experts to fly to the scene of disasters to help identify victims, and it marked the birth of the FBI’s Disaster Squad.

Today, agents and latent fingerprint specialists from the Laboratory comprise the Disaster Squad and respond to incidents all over the world. After a tsunami devastated several countries in Southeast Asia in December 2004, the squad deployed to Thailand, working with specialists from many other countries to identify the thousands of victims. Of note, FBI latent print examiners introduced the boiling method as a way to recondition friction ridge skin severely damaged by environmental elements. The technique originated from the work of the Disaster Squad and the New York City Police Department’s Missing Persons Unit to identify victims of 9/11.

More than Casework

Response

As the success of the Disaster Squad indicates, the FBI Laboratory is known as much for its response capabilities as it is for its casework. Several units at the Laboratory respond to crime scenes, natural disasters, hazardous spills, and other incidents, bringing resources not available to local jurisdictions. Personnel from the Hazardous Materials Response Unit, the Evidence Response Team Unit (ERTU), and the Explosives Unit have specialized expertise and equipment to handle hazardous and complex scenes. These units are being called on more often as acts of terrorism increase around the world. Joining resources with response personnel in FBI field offices, local law enforcement and public officials, and other federal agencies remains essential to the safe and successful resolution of these incidents.

The recent collapse of a bridge in Minneapolis serves as an example of the FBI Laboratory’s emergency response capabilities. On August 1, 2007, a heavily traveled, eight-lane interstate bridge collapsed during rush hour, sending vehicles plummeting into the Mississippi River. ERT personnel, Special Agent Bomb Technicians, and Joint Terrorism Task Force members from the FBI’s Minneapolis Field Office first had to determine whether the incident was the result of a terrorist or criminal act. As it became clear that no criminal or terrorism nexus existed, the FBI’s role changed to supporting the investigation of the National Transportation Safety Board and the emergency response of Minneapolis authorities.

Laboratory personnel played a big part in that response. The ERTU coordinated the efforts of ERT personnel at the scene. Specially trained agents from several FBI field offices worked with a visual information specialist from the Laboratory’s Special Projects Unit. Together they mapped the scene using Total Station digital survey equipment and a 3-D, high-resolution laser scanner. The data gathered with this equipment allowed the Special Projects Unit to create 3-D digital images of the scene and the damage to help investigators determine the cause of the collapse.

Because the bridge spanned the Mississippi River, dive teams from the local sheriff’s office, the U.S. Navy, and the FBI supported search and recovery efforts. The ERTU also coordinates the Underwater Search and Evidence Response Team (USERT) program. Dive teams from FBI field offices in New York, Los Angeles, and Washington, D.C., arrived in Minneapolis with the experience and equipment needed to map the debris field and search for victims and evidence. The teams high-tech equipment includes side-scan sonar—which can detect debris in muddy, murky, and silt-filled water—and miniature, remote-controlled submarines that send real-time video of the scene to the surface and can videotape searches for future use.
Training

Training is a high priority for the FBI Laboratory and another way the Laboratory supports the forensic science and law enforcement communities. The Laboratory's Specialized Training Program offers courses in a wide range of subjects, including cryptanalysis, DNA, crime scene techniques, photography, and quality assurance. Laboratory personnel with specialized expertise and years of experience serve as instructors. The courses are provided at no cost to both U.S. and international personnel in law enforcement, government crime laboratories, federal agencies, and the military. The Laboratory pays for travel, lodging, and meals for U.S. students and lodging and meals (but not travel) for international students.

Most of the units assigned to the Laboratory provide training in their areas of expertise for the Specialized Training Program and other training programs sponsored by the Laboratory. This additional training encompasses not only courses in specific methods, such as the forensic analysis of various types of evidence, but also training for programs supported by the Laboratory, such as the Regional Mitochondrial DNA Laboratory Program and the Evidence Response Team Program. Laboratory personnel also provide training to new agents at the FBI and DEA Academies and law enforcement officers attending the National Academy.

The Laboratory also sponsors numerous meetings, conferences, and symposia to share ideas and knowledge among forensic science and law enforcement professionals. For 35 years, the Laboratory has sponsored the annual Crime Laboratory Development Symposium as a way to bring laboratory managers together to discuss issues of importance to them and their laboratories.

The FBI has a strong commitment to the international law enforcement community. The International Law Enforcement Academy (ILEA), established in 1995 in Budapest, Hungary, is a multinational, multiagency effort to support emerging democracies in Eastern Europe. Instructors from several U.S. law enforcement agencies and other countries provide training to international law enforcement and criminal justice officials.

In January 2004, after two years of planning, a forensic science training center opened at the Budapest ILEA. FBI Laboratory personnel helped to plan, design, and equip the facility, with the Laboratory providing more than $1 million of specialized, state-of-the-art equipment. At the grand opening, staff assigned to the Laboratory's Counterterrorism and Forensic Science Research Unit demonstrated the capabilities of the facility's four laboratories: Microscopy, Chemistry/ Multifunctional, DNA, and Instrumental. The new laboratory facility allows the ILEA to incorporate forensic science training into its curriculum for law enforcement officers and offer other specialized forensic science courses to scientists in the countries the ILEA serves.

Authentication

The FBI Laboratory may be called upon to authenticate items. More than a century after President Abraham Lincoln was assassinated by actor John Wilkes Booth at Ford's Theatre, the Laboratory examined three items belonging to Booth: his boot, his diary, and the Deringer pistol he used to shoot the President.

After he shot Lincoln, Booth jumped from the theater box to make his escape. In doing so, he broke his leg. While fleeing from Washington, D.C., he stopped at the home of Dr. Samuel Mudd to receive medical treatment. Mudd cut the boot Booth was wearing from his broken leg.

In 1948 the National Park Service requested that the FBI Laboratory examine the boot to verify writing that appeared inside. The Laboratory used ultraviolet and infrared light to develop the handwriting. After years of deterioration and fading, only some of the words could be read. They appeared to comprise four lines. On the first line, the only legible word was "HENRY." The second line contained the numbers 465, with other illegible writing. “BROADWAY” could be read on the third line, and on the fourth line, two “flourishing capital letters (probably initials) . . . could be seen.

In 1977 the National Park Service requested that the FBI Laboratory examine another artifact from the Lincoln assassination, Booth's diary. The Park Service asked the Laboratory to authenticate the diary and also
to determine if the diary contained any invisible writing. The Laboratory was asked to use any technology available that would not damage the diary.

The Laboratory’s Document Section compared the writing in the diary to Booth’s known writing samples and determined that the writing was the same. In addition, examiners used several techniques—including ultraviolet reflectance, visible fluorescence with ultraviolet excitation, reflected infrared, infrared luminescence, and X-ray—to search for invisible writing, alterations, or other characteristics which would be considered unusual. The examinations uncovered indented writing on one page, but the writing could not be read. Otherwise, no invisible, obliterated, or altered writing or other unusual characteristics were found. Of course, as the Laboratory noted, time had worn away or obliterated some of the writing. Moreover, other examination techniques that might have uncovered secret writings would have destroyed the diary and therefore were not used.

Then, in 1997, the U.S. Park Police and the National Park Service requested that the FBI authenticate the Deringer pistol on display at Ford’s Theatre. The pistol allegedly had been replaced with a replica during a burglary in the late 1960s.

Using a series of photographs, documents, and other historical materials, the Laboratory’s Firearms-Toolmarks Unit (FTU) first had to determine whether the pistol was an authentic derringer before determining whether it was the Deringer used by John Wilkes Booth. To assist in this process, the Laboratory’s Special Photographic Unit (now POISU) superimposed photographs taken of the pistol onto historical images of Booth’s Deringer. FTU examiners analyzed the firearm and recorded its physical characteristics. Examiners also took impressions of the interior of the barrel, the breech plug, and the flash port. Of note, the barrel’s rifling pattern turned in a counterclockwise direction, unlike most derringer pocket pistols. The pistol also had a number of unique imperfections, including a large crack in the forestock that showed signs of having been repaired previously.

With permission, FTU examiners also examined the bullet that had been removed from President Lincoln’s brain during the autopsy in 1865. Though consistent with the type of ammunition used in the Booth Deringer, the bullet was too corroded to be compared accurately with the pistol.

Overall, the physical features and unique characteristics of the pistol submitted by the Park Service compared with the historical documentation received led FTU examiners to determine that the Deringer on display at Ford’s Theatre was indeed the Booth Deringer. It had not been stolen by burglars in the 1960s.

Quality Matters

The FBI has always strived to conduct investigations according to unimpeachable standards, and the FBI Laboratory stands on a foundation built using the scientific method. At the same time, human beings are fallible. They sometimes make mistakes. When errors occur, the FBI and the Laboratory take the steps necessary to correct those errors, mitigate their effects, and prevent their recurrence.

In the 1990s, the FBI and the Laboratory became targets of criticism after questions arose concerning the investigation and examination of evidence in several high-profile cases. The U.S. Department of Justice Office of the Inspector General conducted a review of the FBI Laboratory, while the FBI conducted its own audit and also began a series of initiatives to improve Laboratory policies and practices. These initiatives included:

- Adopting new casework protocols, more stringent case-review procedures, revised courtroom testimony policies, and modified report-preparation procedures.
- Establishing a Quality Assurance Unit to oversee quality assurance for the Laboratory and assist in the accreditation process. The manager of the Quality Assurance and Training Unit now reports directly to the Laboratory Director.
Creating an Evidence Response Team Unit and a program to increase the number of qualified, trained evidence response personnel in all 56 FBI field offices. The ERTU was formed in 1992, and today more than 1100 FBI personnel comprise field office ERTs.

Expanding forensic science into new areas, in part, by establishing the Hazardous Materials Response Unit.

Establishing the Computer Analysis Response Team (CART) to analyze electronic data. CART is now part of the FBI’s Operational Technology Division.

Creating forensic science information systems, including CODIS.

Forming technical working groups in various disciplines, including bombing and explosives matters, to develop standardized protocols and practices. The FBI Laboratory now sponsors nine scientific working groups, devoted to numerous disciplines, including DNA analysis, document examination, and the analysis of chemical, biological, radiological, and nuclear terrorism.

Participating in activities and organizations in the forensic science community, including the American Academy of Forensic Sciences and the American Society of Crime Laboratory Directors, to share opinions and expertise with experts outside the FBI.

Requesting funding for a new, state-of-the-art forensic science laboratory to be built in Quantico, Virginia. That facility was completed in 2003.

In 1997, for the first time in FBI history, then-FBI Director Louis J. Freeh appointed as Laboratory Director an individual from outside the special agent ranks and, in fact, outside the FBI altogether. Donald M. Kerr, Ph.D., had spent much of his career in public service, including six years as director of the Los Alamos National Laboratory. Expectations were high for Dr. Kerr to put the Laboratory on the right track and reestablish its place as the premier forensic laboratory in the world. During his first year, he ensured that all of the Inspector General’s recommendations were implemented, including applying for accreditation by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). In September 1998, the Laboratory achieved outside accreditation through ASCLD/LAB.

During his tenure, Dr. Kerr strengthened ties with the forensic, scientific, and law enforcement communities. He established several scientific working groups, encouraged Laboratory personnel to train individuals from the forensic and law enforcement communities, and supported the hosting of conferences, working groups, and symposia by the Laboratory.

Under Dr. Kerr’s direction, Forensic Science Communications (FSC) premiered in April 1999. Published entirely online, this peer-reviewed journal serves as a means of communication between forensic science professionals worldwide. FSC superseded Crime Laboratory Digest, a print journal published from March 1974 through spring 1997. Crime Laboratory Digest grew out of an FBI-sponsored Crime Laboratory Development Symposium, where participants suggested a means of communication between laboratory directors and managers.

FBI Laboratory Personnel

At the Laboratory’s inception, most employees were special agents. For many years, it was believed that only a special agent had the right combination of knowledge and investigative expertise to solve cases and testify in matters for the FBI Laboratory. Today, however, most of the approximately 500 employees assigned to the FBI Laboratory are professional support personnel. Most have college degrees, and many have advanced degrees. FBI Laboratory forensic examiners follow a rigorous certification process that involves one to two
years of training and testing. Until they become certified, forensic examiners cannot perform analyses and present their findings in court.

Laboratory scientists are recognized experts in their fields. In addition to working cases, they train other forensic science and law enforcement personnel, facilitate and attend conferences and symposia, and publish their research in peer-reviewed journals.

Because they are not subject to the same transfer policies and mandatory retirement as special agents, the Laboratory’s professional support employees spend years developing their expertise in their chosen fields of study. At the same time, the broad range of disciplines under the Laboratory umbrella—including quality assurance, training, evidence control, forensic science analysis and research, and management—offers personnel the opportunity to work in a variety of challenging positions.

A Foundation for the Future
For more than 70 years of its existence, the FBI Laboratory was located in downtown Washington, D.C., sharing a building with other FBI Headquarters divisions. Clearly, for quality and safety reasons, the Laboratory needed its own dedicated space. The process began in the mid-1990s, when the FBI received approval and funding from Congress to build a new Laboratory building in Quantico, Virginia. In 1998, the building plans were finalized, and on September 1, 1999, a groundbreaking ceremony was held onsite, with then-Director Louis Freeh, then-Laboratory Director Donald Kerr, and other dignitaries performing the honors.

Beginning in January 2003 and culminating in a dedication ceremony on April 25, 2003, the Laboratory moved into its new 500,000-square-foot facility. The massive granite stone near the entrance reminds employees and visitors alike that the new Laboratory is dedicated to crime victims and their families.

The building features specialized laboratory areas separate from offices and public access, as well as a 900-space parking garage and a separate central utilities plant. Strict access requirements ensure that only authorized individuals gain entry to the building and evidence-handling and examination areas. Laboratory examiners must pass through specially designed biovestibules, which serve as airlocks between laboratory and office space, to change into and out of laboratory apparel. These measures prevent evidence from becoming contaminated and keep personnel from being exposed to hazardous materials and pathogens.

The Laboratory continues to evolve. Over the years, some units—such as the Language Services Unit; the Polygraph Unit; the Computer Analysis Response Team; and the Forensic Audio, Video, and Image Analysis Unit—have been transferred to other FBI divisions to better serve their core constituents. At the same time, the Laboratory has created new entities to better achieve its mission. The Chemical-Biological Sciences Unit develops analytical plans and partners with other laboratories to conduct and direct the forensic examination of chemical, biological, radiological, and nuclear materials. The IT (Information Technology) Coordination Group is helping the Laboratory improve its business processes using automation. The Terrorist Explosive Device Analytical Center is a vital component in the fight against terrorism. As the 21st century unfolds and crime patterns and priorities change, the Laboratory will change in response. But most important, the Laboratory will take proactive steps to ensure that it can address whatever the future holds.

Conclusion
Seventy-five years ago, two men with a vision of how science could help solve crimes started the FBI Laboratory. Despite having great insight, neither man probably envisioned how much the world would change and how the FBI and the Laboratory would change to meet those challenges. The FBI has transformed from solely a law enforcement agency to also an intelligence agency tasked with preventing a terrorist attack on U.S. soil. Instead of gangster John Dillinger, the FBI’s “most wanted” is Usama bin Laden, a terrorist leader. Laboratory personnel are increasingly called to examine evidence from explosive and incendiary devices.

Today's criminals have the means and the motivation to cause widespread panic and destruction. The criminal justice, intelligence, and forensic science communities need to keep pace by using the most advanced tools and techniques available. In 1961, when the Justice Department asked Congress to legalize state and federal wiretaps, Assistant Attorney General Herbert J. Miller said, “Law enforcement officials should be as
free as criminals to use modern scientific methods.” Clearly, Miller recognized the value of science and technology in fighting criminals, who sometimes seem to be one step ahead of law enforcement.

Yet, in the United States, more than half of all state and local law enforcement agencies employ fewer than 10 officers. They often do not have the resources to fulfill the obligations imposed on them by a society rife with crime. Meanwhile, crime has become increasingly global, and not many agencies can send their personnel halfway around the world to conduct investigations. Fortunately, the federal government does have the means and, moreover, the mission to help state and local agencies protect the residents of their jurisdictions.

As part of the federal government, the FBI and the FBI Laboratory sometimes face budgetary constraints. The desire to provide cost-free forensic services to every law enforcement agency that requests them and the resources to do so are not always compatible. The FBI Laboratory must balance the needs of its constituents with its own resources.

Regardless of the circumstances, the FBI Laboratory will continue to serve the public by providing forensic services and support to its law enforcement, intelligence community, and forensic science partners. Indeed, FBI personnel take the title “public servant” very seriously. Partnerships, teamwork, dedication, quality: these common threads weave through the fabric of the FBI Laboratory and mean the difference between success and failure.

The FBI Laboratory had humble beginnings, examining fewer than 1000 pieces of evidence in its first year. Today, Laboratory examinations total approximately one million or more each year. Items of evidence may be as large as the fuselage from an aircraft or, thanks to scientific advances, as small as the cells of a person’s skin. Firearms and handwriting analysis once dominated the Laboratory’s caseload. Today, Laboratory casework covers a multitude of disciplines, including trace evidence, chemistry, latent prints, DNA, and explosives. One special agent started the Laboratory in one room with a borrowed microscope and a few other pieces of equipment. Today, approximately 500 Laboratory employees work in a world-class facility and use the most advanced tools, techniques, and technology available. J. Edgar Hoover’s vision of creating the foremost crime laboratory and applying scientific principles to solving cases has truly come to pass.