

# Crime Laboratory Division

The Missouri State Highway Patrol Crime Laboratory opened in May 1936, in Jefferson City, only five years after the inception of the agency itself. Very early in the history of the Patrol, forensic science was recognized as an essential element of the criminal investigation process. It was one of the first crime laboratories in the country. The lab was located first in two rooms within the Broadway State Office Building. In 1963, the laboratory moved into 4,000 square feet of space in the basement of the new General Headquarters building on Elm Street. It moved again in October 1979, this time into 11,000 square feet of the Annex Building, on the General Headquarters campus. Today, the General Headquarters lab has expanded to fill approximately 16,000 square feet in that same building.

The facility at GHQ was originally constructed to accommodate a staff of 15 personnel and an annual caseload of 2,500 cases. Today, with the addition of 5,000 square feet, the lab houses 53 criminalists and technicians with an annual caseload of 6,500 cases. Over the years, the laboratory has expanded into a system of strategically located crime labs by the addition of seven satellite laboratories in Macon, St. Joseph, Park Hills, Cape Girardeau, Willow Springs, Springfield, and Carthage.

The Crime Laboratory Division, the system and each laboratory, is accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). It was first accredited in 1984, and was the 23rd laboratory in the nation to earn this distinction. The accreditation process involves internal annual reviews, external DNA audits every two years, and a comprehensive external inspection of the entire laboratory operation every five years by ASCLD/LAB assessors. The purpose of the accreditation process is to demonstrate that the laboratory is complying with required accreditation standards and criteria, thus ensuring that the examinations being conducted are of the highest possible quality within a highly functional quality management system.

## The Main Laboratory

At the beginning of its operation, the Patrol Crime Laboratory was manned by uniformed officers of the Patrol. This continued until the first two civilian chemists were hired in 1962. The first chemist hired was Afton Ware, who preceded Frank Durham by only one month. For the first 20 years the chemists were "generalists". They performed blood alcohol, chemical, drug, microscopic, and trace evidence testing. Other non-chemistry analyses such as firearms functioning, toolmarks, and fingerprints were still being analyzed by trained uniformed officers at that time. "Essentially, it was on-the-job training. Afton and I visited the St. Louis City Lab and the St. Louis County Coroner's Lab. They gave us some of their procedures. And, we had books in the laboratory library that helped us," said retired Criminalist Supervisor Frank Durham, of his training, during a 2006 interview.

In the late '60s, the uniformed officers began turning over their firearms, toolmarks, and fingerprint work to civilians. In 1968, Tom Buel, who had been the Patrol's civilian photographer since 1965, added firearms, toolmarks, and footwear to his duties. In 1975, he began a two-year apprenticeship program in questioned documents, which was taught by the Crime Lab's director, Captain Kenneth Miller.

In 1974, Don Lock was hired to perform fingerprint analyses and, along with Tom Buel and August Nilges, began analyzing questioned documents. Lock had previously been working in the Patrol's Criminal Records Division classifying and identifying inked prints. In 1987, he became the supervisor of both the Questioned Documents and Latent Fingerprints sections of the laboratory.

In the early 1980s, the chemists became more specialized because of increasing workloads and advances in technology. During that time, the Serology Section of the laboratory, which was using polymorphic enzyme comparisons and blood typing on a daily basis, started making advancements that would lead to the development of the present DNA casework section.

"They can do so much more now than we could do then. ... there were times we could not say there was definitely a match. Now, with DNA, they can make positive matches. The instrumentation is much more involved. Initially, a lot of the chemical procedures were very tedious and took a long time. It isn't easy now, but it's different," said Durham (2006). Today, the General Headquarters laboratory is a full-service crime laboratory, providing services in firearms and toolmarks, fingerprints, trace evidence, DNA casework, DNA profiling, drug chemistry, and toxicology.

## **Expanding The Lab System**

The satellite laboratories are now an integral part of the laboratory system. The first satellite laboratory opened in February 1975 at the Troop G Headquarters in Willow Springs. In September 1997, the staff moved into a new laboratory facility located on the grounds of Troop G Headquarters.

The Troop H Satellite Laboratory, located on the Troop H Headquarters' grounds in St. Joseph, opened in February 1977. In 1988, an addition to the original laboratory structure nearly doubled the space of the laboratory.

The Troop B Satellite Laboratory, located on the same property as the Troop B Headquarters in Macon, opened in February 1977. In 1988, an addition was made to this structure that nearly doubled the working space. Additional renovations in 2008 improved the floor plan of the lab.

The Troop C Satellite Laboratory was opened in January 1992. The laboratory was originally operated as the Jefferson County Regional Crime Laboratory, under the authority of the Jefferson County Sheriff's Department. It was located at Jefferson Community College in Hillsboro, MO. When the regional laboratory closed, the previous management requested the MSHP take over the operation of the laboratory. A new laboratory facility was constructed in April 1999, on the Mineral Area Community College campus at Park Hills.

The Troop D Satellite Laboratory opened in January 1993, to serve the Patrol's needs in the Southwest Missouri region. Soon afterward, the Springfield Police Department elected to close its regional crime laboratory. A merger occurred between the Springfield Police Department's regional crime lab and the Highway Patrol Troop D lab, resulting in the Highway Patrol crime lab system taking over the functions of the regional lab. In 2008, a new facility was constructed and outfitted using a combination of state, local, and federal funds. While the previous Troop D lab only performed solid dosage drug analyses and blood alcohol determinations, the new 30,000 square foot facility is a full service crime lab offering all forensic disciplines, including drug chemistry, toxicology, trace evidence, latent prints, firearms, toolmarks, and DNA. This new full service lab provides a much needed expansion of analysis capacity for the fast-growing Southwest Missouri region.

Since its creation, the Crime Laboratory Division has accepted submissions from any Missouri law enforcement agency. According to a biennial report of the Patrol, the Laboratory worked 230 cases in 1937-1938. Criminal case submissions to the Laboratory have grown to 23,801 in 2009. Presently, approximately 75 percent of the cases received by the Crime Laboratory Division are submitted by outside agencies such as municipal police departments, county sheriff's departments, and county coroners. Forensic lab services are provided to these submitting agencies at no charge. Forensic examination of evidence is essential for the successful investigation and prosecution of criminal cases.

Currently, there are no uniformed members assigned to the Crime Laboratory Division. The 104 employees are all civilian, consisting of management, criminalists, and evidence technicians.

### **Merger With The SEMO Regional Crime Lab**

In mid-2006, the Southeast Missouri Regional Crime Lab in Cape Girardeau became part of the Missouri State Highway Patrol Crime Laboratory System. It is located near the campus of Southeast Missouri State University and serves the Southeast Missouri area. The lab was founded under the leadership of Dr. Robert C. Briner in 1970, through funding received from a federal grant program. It operated under the administrative auspices of Southeast Missouri State University (SEMO). The laboratory has served the law enforcement agencies in the Southeast Missouri area for over 40 years.

For over 30 years, the SEMO lab was funded by federal and state grants, as well as through local agency fees for service. Relying on these uncertain funding sources made it increasingly difficult for the SEMO lab to maintain the services that the local law enforcement community needed. Through the efforts of Senator Rob Mayer, Senator Jason Crowell, and Representative Scott Lipke funding was provided to merge the SEMO Crime Lab into the Missouri State Highway Patrol crime lab system. Governor Matt Blunt approved the merger and signed the budget, establishing the funding to make this merger possible.

Effective July 1, 2006, the seven employees of the SEMO Crime Lab officially became employees of the Missouri State Highway Patrol. The new Troop E lab achieved accreditation through the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) in 2008, and gained approval from the FBI to participate in the CODIS DNA database shortly afterward.

## **Merger With The Missouri Southern State University Regional Crime Laboratory**

In mid-2007, the Missouri Southern State University (MSSU) Regional Crime Lab, located on the campus of MSSU in Joplin, became part of the Missouri State Highway Patrol crime laboratory system. It serves the extreme Southwest Missouri area. The MSSU regional lab was founded under the leadership of Dr. Phillip Whittle in the 1970s through funding received from a federal grant program. The laboratory served many law enforcement agencies in Southwest Missouri and adjacent parts of Oklahoma, Arkansas, and Kansas.

For over 30 years, the MSSU regional lab was funded by federal and state grants, as well as through local agency fees for service. As was the case with the SEMO lab, relying on these uncertain funding sources made it increasingly difficult for the MSSU regional lab to maintain the services that the local law enforcement community needed. Through the efforts of Senator Gary Nodler, funding was provided to merge the MSSU Regional Crime Lab into the Missouri State Highway Patrol crime lab system. Governor Matt Blunt approved the merger and signed the budget, establishing the funding to make this merger possible.

On June 1, 2007, the seven employees of the MSSU Regional Crime Lab officially became employees of the Missouri State Highway Patrol. In 2009, the Missouri Southern State University reallocated the rooms occupied by the crime laboratory. In response to losing this facility, a new laboratory was built in Carthage at the local Highway Patrol Troop D Service Center.

The new 6,000-square-foot facility opened for business in September 2010. This laboratory offers services in Latent Prints and Drug Chemistry, with room for further expansion.

## **Developing DNA Analysis capabilities**

The implementation of DNA analysis by the MSHP Crime Laboratory began with an idea, an application, a journey, and a commitment.

**The Idea** -- Colonel C.E. Fisher attended a meeting in 1988, where a new testing procedure that "typed" a person's DNA was discussed. Col. Fisher returned to Jefferson City and discussed with Laboratory Director Lt. Frank Burkhead the pros and cons of DNA typing. They agreed the MSHP Crime Laboratory should be on the cutting edge of technology and that the timing was right for implementation of this new technology in Missouri.

**The Application** -- Soon after this discussion, the FBI Laboratory began soliciting applicants for their Visiting Scientist Program at their research lab in Quantico, VA. This program was instituted so state and local forensic scientists from the United States could work in together with FBI researchers to develop a national system for analyzing human DNA. All participants would be taught to use the same techniques and procedures for typing human DNA. Since all of the labs in the country would be using the same techniques, their results would be compatible and could be incorporated (eventually) into a national DNA database. The FBI benefited by developing a consistent analytical system and by utilizing the labor of the scientists from the participating labs to develop a national DNA population database that could be used to calculate the rarity of a DNA type. In April 1988, Lt. Burkhead received one of the applications and discussed with Tom Grant, the supervisor of the MSHP Lab's Serology Section, the possibility of Sprv. Grant submitting an application. Sprv. Grant returned the application and waited. In July 1988, the FBI sent a letter confirming that Tom Grant had been chosen as one of the first visiting scientists. His participation included four months of resident service at the research lab in Quantico.

**The Journey** -- The timing allowed Sprv. Grant's family to accompany him to Virginia to learn about and to experience life on the East Coast. The family rented a townhouse in Fredericksburg, VA, and Tom began working with the FBI. The Grant children--Tanya, Travis, and Tracy--enrolled in the Spotsylvania County Public Schools. Louise was the coordinator of everyone's schedules and kept the family together.

**The Commitment** -- For four months, Sprv. Grant helped work on the population database and was trained to perform Restriction Fragment Length Polymorphism (RFLP) DNA analysis. His new knowledge helped equip the DNA Section of the laboratory. Lt. Burkhead committed lab funds to purchase the necessary equipment to set up a DNA testing laboratory. The MSHP DNA staff ordered the equipment Sprv. Grant recommended from his experience in the research lab.

When Sprv. Grant returned to Missouri in February 1989, the General Headquarters laboratory was equipped and ready to begin validation of DNA analysis methods. Staff training started and progressed rapidly. On October 1, 1990, the first DNA case was started in the MSHP Crime Laboratory. The techniques continued to develop over the years and, in 1999, Polymerase Chain Reaction (PCR) using Short Tandem Repeats (STR) was instituted with casework samples and is the technique currently being used. Over the past 20 years, much has changed in the field of DNA analysis -- new techniques, faster turnaround times, and more discriminating results.

The DNA Section staff has expanded from three criminalists in one lab to 18 criminalists in three labs across the state. The MSHP Crime Laboratory is still on the cutting edge of the technology and the FBI Visiting Scientist Program was the initial link in an ever-growing chain of events.

## **Laboratory Specialization**

In the mid-1980s it became apparent that it was no longer practical for criminalists to be generalists. The forensic chemists performed all chemistry disciplines,

forensic serologists did enzyme typing on stains, while the forensic analysts performed latent prints, and firearms and toolmark analyses. It was determined that the chemistry and serology disciplines had become too specialized for any one analyst to be proficient at all of them. In 1986, a Trace Evidence Section and a Toxicology Section were formed. The Trace Evidence Section analyzes hairs, fibers, glass, paint, filaments, gunshot residue, soil, fire debris, paint, and other unknown substances. The Toxicology Section analyzes body fluids for the presence of ethyl alcohol and drugs. Those chemists that primarily analyzed solid dosage drugs became the Chemistry Section. The end result was a full service laboratory with six basic forensic disciplines: Chemistry, Toxicology, Trace Evidence, Serology (later DNA), Firearms and Toolmarks, and Latent Prints. The questioned documents function was phased out in 2003.

## **The DNA Database**

In 1991, Senate Bill 578 was passed requiring the collection and processing of DNA samples from convicted felons of certain violent crimes and to record them in a state and national database. The DNA Profiling Section of the laboratory was established to perform these new duties. This section was required to collect and analyze the DNA samples. The resultant DNA profiles were entered into a state and national DNA database, the Combined DNA Index System (CODIS). Those profiles are then compared to the DNA profiles from evidence collected at a crime scene.

The passage of Senate Bill 1000 during the 2004 legislative session (made effective January 1, 2005) had a tremendous impact on law enforcement's ability to solve crimes through the use of the CODIS database. This legislation expanded Missouri's offender DNA database law to require collection of DNA from all felons. The expansion of this program is funded by a court fee of \$30 assessed on every felony conviction and \$15 on every misdemeanor conviction in the state. This law increased estimated annual DNA submissions to the Missouri State Highway Patrol Crime Laboratory from approximately 2,200 offender samples per year to over 28,000 per year, with an additional 100,000 DNA samples to be collected immediately from prior offenders now eligible for collection for past felonies. A seven year plan was instituted to eliminate this backlog of samples and stay current with the new samples arriving. Faced with this monumental task, the employees of the DNA Profiling Section were able to eliminate the entire backlog in just two years. Because of their dedication and efficiency, the section was presented with a 2006 Governor's Award for Quality and Productivity in a ceremony at Missouri's Capitol.

In the 2009 legislative session the database law was expanded again with the passage of HB 152 requiring the collection of individuals arrested for qualifying crimes. It has long been known that a large percentage of serious crimes are committed by persons previously convicted of lesser felony offenses. This offender database is used to search against forensic DNA samples from unsolved crimes at the state and national level. The Missouri forensic database contains DNA from thousands of unsolved crimes and it is constantly being searched against newly entered offender DNA samples.

In the 12 prior years, under the old law, the Crime Laboratory analyzed a total of 27,211 convicted offender DNA samples and uploaded the profiles into the state and national CODIS database. Since the change in the law took effect, the database has increased in size from 27,211 DNA profiles to almost 200,000 convicted offender profiles.

As expected, the large increase in DNA profiles from relatively recent offenders has resulted in a tremendous increase in CODIS "hits", where old unsolved crimes have hit against a newly collected offender. For 2004, the last year the laboratory worked under the old law, there were a total of 41 CODIS "hits". For 2005, the first year under the "all felon" law, these hits increased to 175. For 2009, there have been an astounding 895 "hits". While the majority of the hits from 2009 have been related to property crimes such as burglary, they also include 73 homicides or manslaughter cases and 138 sexual assaults. A number of these hits are very high profile cases. Without this valuable new tool, these crimes would have remained unsolved.

The power of CODIS resides in its ability to identify perpetrators of unsolved crimes. Also, the database has the potential to identify repeat offenders, and in doing so, help reduce or prevent the occurrence of serial crimes. The high degree of certainty that DNA analysis provides has caused it to become one of the most important criminal justice tools ever utilized. DNA is equally effective in exonerating the innocent as in convicting the guilty.

In 2010, the CODIS Section analyzed 21,872 offender DNA samples and produced a total of 790 "hits" between crime scene samples and offender samples in the database. The DNA Section transferred one of their criminalists to the Cape Girardeau Lab, giving them three DNA analysts and the GHQ Lab six.

### **A Case Study: Governor Carnahan's Plane Crash**

On October 16, 2000, a Cessna airplane piloted by Randy Carnahan, son of Governor Mel Carnahan, crashed on a heavily wooded hillside south of St. Louis near Hillsboro, MO. Gov. Carnahan and his aide, Chris Sifford, were the other occupants of the plane. All three men were killed in the crash.

Because of the stature of the occupants of the plane and the importance of the transfer of power in state government, it became vitally important to quickly and indisputably identify the deceased. Positive identification can be accomplished by several means, two of which are performed routinely at the Missouri State Highway Patrol Crime Lab in Jefferson City. Fingerprints and DNA analysis, techniques performed daily at the state laboratory, would prove essential to the timely identification of the victims of this plane crash.

Almost immediately after the crash, materials began arriving at the lab. Before any comparisons could be made with evidence from the crash site, known standards from the three individuals had to be established. A call went out to track down any 10-print cards that may have been on file from any of the deceased. Personal effects such as toothbrushes, razors, caps, and clothing were submitted to establish a DNA profile for each individual. Analyses began on these items as Dr. Mary Case, the medical

examiner in St. Louis, conducted preliminary examinations on the crash site evidence. The lab prepared to work around the clock in anticipation of the crash samples that would be submitted.

In addition to the work done to identify the crash victims, other investigations were being conducted to determine the cause of the crash. The lab became peripherally involved in these issues as well. The Trace Evidence Section was called upon to analyze aviation fuel samples for any contaminants. The Drug Analysis Section was asked to analyze an unknown powder found at the site. These analyses were conducted with the utmost speed and accuracy.

As samples from the crash victims came in from the Medical Examiner's Office, they were quickly logged in by the laboratory records and evidence control clerks and prepared by criminalists for fingerprint and DNA analysis. Many of these exams extended late into the night as the samples were submitted at all hours of the day. Using recently obtained 10-print cards and the newly developed DNA standards, criminalists were able to positively identify which biological crash materials belonged to each of the three deceased. By working around the clock, the lab was able to make many of these identifications in time for the funeral arrangements a few days later. DNA results were eventually used by the Federal Aviation Administration to resolve identification issues with some of the tissue samples they subjected to toxicology examinations.

On March 7, 2001, the Missouri House of Representatives, 91st General Assembly passed House Resolutions 761 through 771, recognizing the exemplary work done by Crime Lab personnel during this time of crisis. It serves as public testament to the competence and professionalism of Missouri State Highway Patrol Crime Laboratory personnel.

### **A Case Study: Fingerprint Database Success**

A case was solved with the help of the FBI's IAFIS database. A stealing case originated in Taney County, MO, and was later associated with crimes from Arizona, Colorado, Idaho, Montana, Nebraska, Texas, and Wyoming. The suspect, using several aliases, stole hundreds of thousands of dollars worth of merchandise from several ranches. An FBI task force had been formed in an attempt to locate this individual. The IAFIS hit, originating with the Latent Prints Section and the Taney County stealing case, was the first piece of evidence identifying the suspect and tying him to these crimes.

In 2009, the Latent Print Section obtained two AFIS terminals for direct entry of prints into the database. Future planned expansion with more terminals will further reduce the turnaround time for latent print entry and searches.

### **Other Notable Laboratory Highlights**

In 2000, Criminalist Susanne Brenneke was tasked with validating a new DNA kit--the PowerPlex 16 system--prior to using it in the Crime Laboratory. This kit was

better suited for DNA analysis in the Crime Lab due to its greater efficiency and lower cost. The study was designed to evaluate the concordance, reproducibility, sensitivity, and forensic applicability of the system. The Patrol's Crime Lab was one of the first to validate this system, which led to Promega Corporation inviting Criminalist Brenneke to share her findings at a meeting of the European STR Working Group in Krakow, Poland, on September 11, 2000. The meeting provided a forum that facilitated global networking among forensic scientists and encouraged discussion in forensic analysis.

In 2001, the premier issue of "Under The Scope" rolled off the press. This newsletter is an effective tool for educating our submitting agencies on current crime laboratory issues. "Under The Scope" is a way to disseminate information such as techniques, procedures, and policies.

In 2003, the Crime Laboratory Division worked closely with Information Systems Division and software consultants on the design and development of a replacement for the existing laboratory computer system. The old system was based on the AS/400 platform and was inadequate for present demands. The new system, known as a Laboratory Information Management System (LIMS), integrates the many databases in use throughout the laboratory and also connects the GHQ system with the satellite labs. The new LIMS is connected also to the Patrol Property Control System, so that Patrol property evidence officers can enter their evidence items directly into the LIMS using a barcode system.

In 2004, Crime Laboratory Division personnel worked closely with the State Health Lab to establish a coordinated plan of action to be used in the event of a chemical terrorism incident. A network of specialists are involved. They represent laboratories and other facilities from many areas of state government, as well as members of the U.S. Army's Fort Leonard Wood Chemical Response Unit.

The Crime Laboratory Division constructed a highly informative website accessible from the Patrol's main website. Many of the publications the Crime Laboratory Division distributes, such as the "Evidence Handbook" and the "Under the Scope" newsletters, are available electronically on the website. To view the Crime Lab website, go to [www.mshp.dps.mo.gov](http://www.mshp.dps.mo.gov), and click on the link to "Crime Lab".

As mentioned earlier, the Missouri State Highway Patrol Crime Laboratory Division has been in existence since 1936. Forensic science has been an integral part of the criminal investigation process for many years, and this relationship has only grown stronger through time. From those humble origins in 1936, the division has evolved into a nationally respected and internationally accredited crime laboratory system that is a recognized leader in state-of-the-art forensic science services in the 21st century. The pride and commitment to quality that defined the laboratory then endures even more strongly today.

At the end of 2010, the system had a total of 104 FTEs. In that same year, the laboratory received 24,661 cases. Remodeling of the Firearms and Latent Prints sections took place in 2010 to help make the existing space more efficient. Latent Prints expanded personnel by adding two criminalists: one in Springfield and one in Cape Girardeau.