Minnesota Department of Public Safety

Bureau of Criminal Apprehension

Forensic Science Service

St. Paul Forensic Science Laboratory

Bemidji Forensic Science Laboratory

2006 Annual Report

MINNESOTA BCA FORENSIC SCIENCE SERVICE
2006 ANNUAL REPORT

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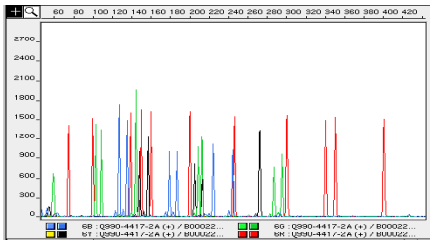
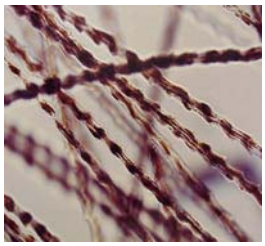




Message from Frank C. Dolejsi, Director

☑ **Forensic Science Service Mission, Vision and Values**

- *Mission Statement:* "The BCA Forensic Science Service provides quality forensic science services for the Criminal Justice community and fosters partnerships that promote research, education and overall forensic science laboratory improvement."
- *Vision:* *"Seeking truth through science."*
- *Values:* "Espouse `*Science is Neutral'*", "Honesty and Integrity", "Laboratory Excellence", "Accountability."

☑ **Quality:**

Our commitment to Quality is demonstrated through our Quality Assurance Program. The laboratory system quality manager is Debra Springer; she can be contacted at 615-793-2895 or debra.a.springer@state.mn.us

Both the St. Paul and Bemidji Laboratories are accredited under the ASCLD/LAB Legacy Program. Visit: http://www.ascld-lab.org/ for more information.

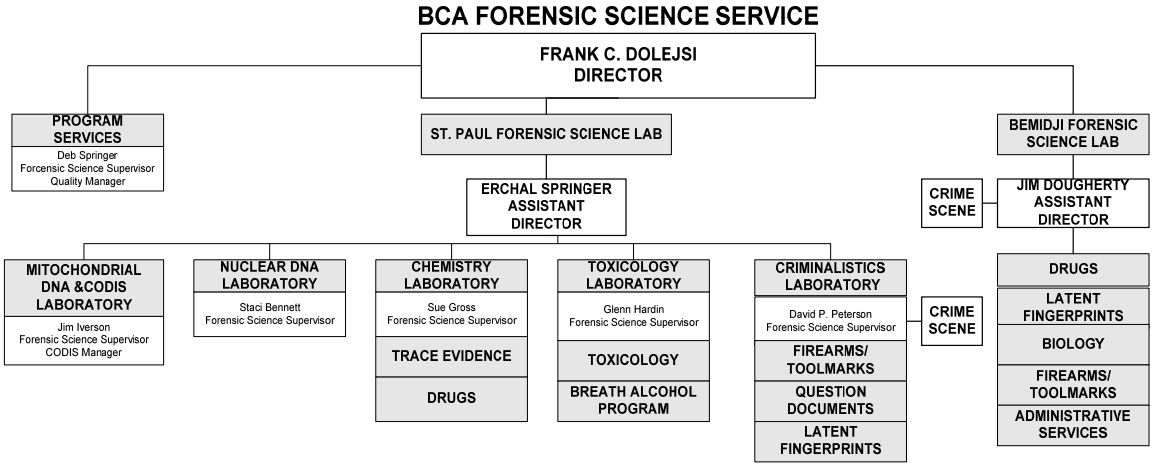
☑ **Turn around time:**

Our stated goal is a 30 day turn around time on all cases. The average turn around time doesn't tell the entire story. For example over 90% of alcohol cases are completed in two weeks. With DNA cases 7% are completed in less than 7 days, with 26% completed in less than 30 days. The bottom line is that we do work with our clients in high profile cases to meet their special needs.

☑ **Outcomes:**

The BCA Forensic Science Laboratories examined over 14,000 cases in 2006 and there were 277 cases linked through the CODIS.

☑ **Organization and contacts:**



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St. Paul 651-793-2900; Bemidji 218-755-6600 or bca.lab@state.mn.us

Biology/Nuclear DNA Section

The nuclear DNA section had a very productive year in 2006. Over 2500 reports were issued, which is a marked increase over the previous year's total of just over 1500 reports, and the average turn around time for nuclear DNA section cases was reduced. This increase in production has helped to drastically reduce the sections backlog of cases. Three additional case working scientists were added to the nuclear DNA section, including one nuclear DNA scientist, and two scientists that will be performing serological analysis of evidence. With the extra help and continued diligence on the part of all the section's scientists, the backlog should completely be eliminated in 2007.

In 2006, over 250 investigations were aided from hits to databases within the Combined DNA Index System (CODIS) including 40 hits to the forensic database and 208 hits to the convicted offender database. These databases continued to be an invaluable investigative tool, helping to link suspects to non-suspect cases.

The Nuclear DNA section continues to research and implement new and improved technologies and methods adding to services provided to the law enforcement community. In 2006 the statistical analysis software was upgraded which has allowed for more genetic information to be statistically analyzed and has reduced the amount of time spent on the statistical analysis of data. There are several projects planned for 2007, involving research into the improvement of current methodologies and research into recent technological advances within the field of nuclear DNA analysis that the section hopes to eventually implement into casework.

Offender DNA Database Section

The Offender DNA Database Section has experienced continued success this past year. In 2006, the BCA Lab was able to assist 277 criminal investigations using information obtained from the Combined DNA Index System (CODIS). In May and June of 2006, the Offender Section welcomed two new scientists, Julie Envall and Rebecca Dian; bringing the number of Offender Database scientists to five. Since the addition of these scientists, the backlog of offender samples has been significantly reduced. It is anticipated that the group will be up to date with samples received by March 2007. Once this is achieved, the goal is to have all samples analyzed and placed into the database within thirty days of receipt.

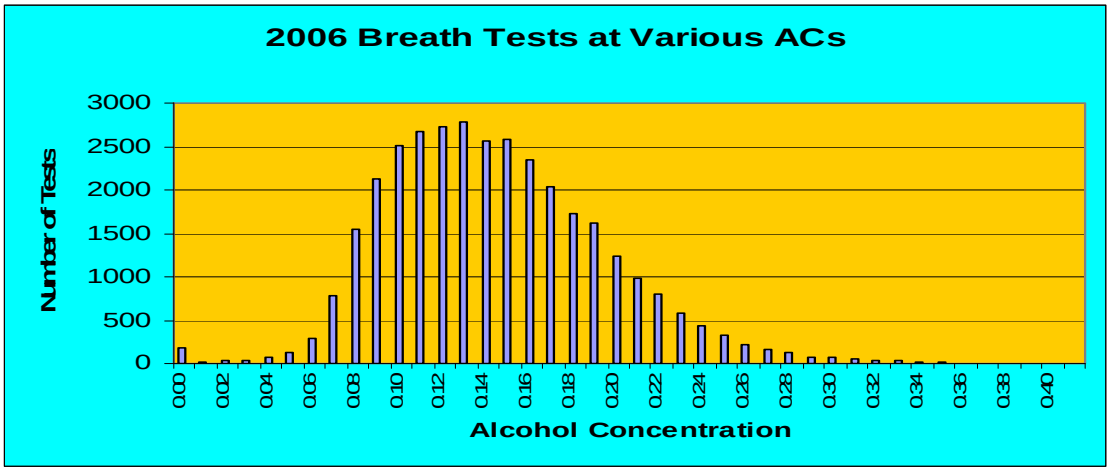
The BCA has been profiling DNA collected from convicted offenders since 1990. Over the years, laws have continued to change regarding the DNA profiling of criminal offenders. In 2002, a law was enacted requiring DNA testing of all people convicted of a felony. In 2005 the law expanded to include persons arrested for violent crimes. However; in October 2006, the legislature found parts of the statute requiring arrestees to provide a DNA sample for profiling unconstitutional. The Offender Section has thus suspended profiling those samples. Since the new ruling, the Offender Group scientists have been busy mailing thousands of letters to agencies to request the re-collection of

DNA samples from those who had DNA collected pre-conviction and have since been convicted. It has been a time consuming, and often difficult, task; however, newly collected samples have begun to roll in.

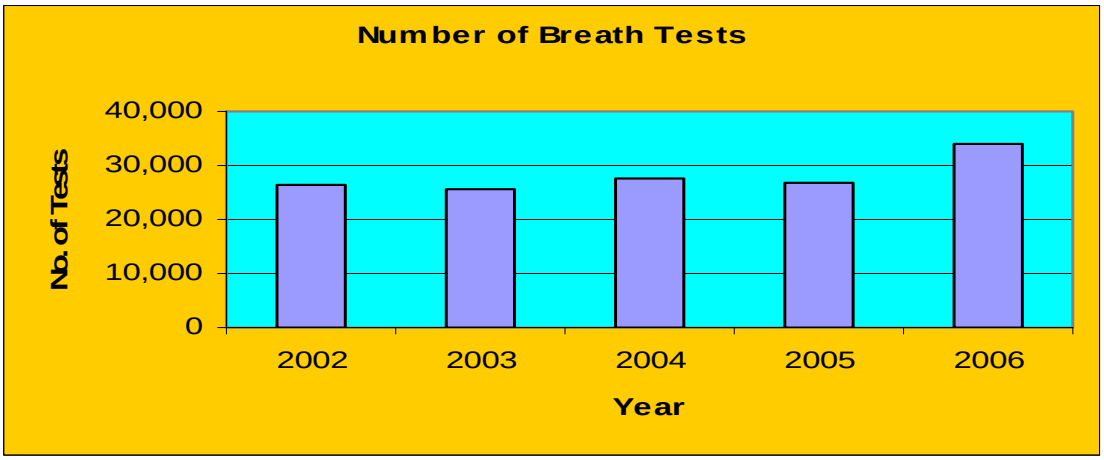
Julie & Rebecca

Breath Testing

Certified breath test operators completed 33,942 evidentiary breath-alcohol tests using 200 Intoxilyzer 5000EN instruments located throughout Minnesota during 2006, a jump of 26% over 2005. 2006 was the first full year since the change to an alcohol concentration of 0.08 as the legal standard for impaired driving, and the number of breath tests at 0.08 was 1548, more than triple the number in 2004, the last full year of 0.10.



Also during 2006 the Breath Testing Section received 713 requests to provide expert testimony in court, resulting in 93 appearances and 51 instances where expert testimony was provided, an increase of 50% over last year.



Education is a major focus of the Breath Testing Section. In 2006, 317 new Intoxilyzer operators were certified and 1360 experienced operators were recertified. Newly appointed and experienced judges received training on *Alcohol and the Intoxilyzer* last year. We served as instructors for attorney groups and at various area universities and colleges. Breath testing staff also attended annual meetings of the International Association for Chemical Testing and the Intoxilyzer User's Group.

Our most interesting case this year concerned an individual who claimed to have eaten a hot slice of pizza that caused burns and bleeding inside the mouth. It was alleged that this bleeding in the mouth interfered with the Intoxilyzer 5000EN's ability to accurately measure the subject's breath alcohol concentration. Through skillful expert scientific testimony this allegation was effectively refuted.

Crime Scene Response

In addition to their normal duties as drug and arson chemists, DNA analysts, toxicology experts and comparative examiners, the 26 members and leaders of the Crime Scene Team must remain proficient in all aspects of forensic evidence identification and collection. This past year, written and practical exams were completed involving tire track measurements, enhancing images in blood on various surfaces, and the use of the metal detector to locate hidden objects.

When correct measurements are taken from tire tracks left at a scene, they can be entered into a computer program which will identify the vehicles responsible by brand and model. Blood, obviously, is a substance often encountered at our scenes. Impressions, such as finger and palm prints, can be enhanced by using the correct chemical for the contaminated surface, be it porous or non-porous. Metal detectors can be invaluable to look for that stray bullet, cartridge case, or other metallic items of evidence. The team was able to successfully demonstrate their proficiency in these tasks.

Also this past year, the topic of bloodstain pattern analysis was addressed. For some team members, this was refresher training and for others, this was a brand new discipline. Mock scenes were created and analyzed for impact spatter, contact stains and various smears, swipes and other patterns. Detailed notes, sketches and photos must also be taken and are essential elements when writing the report. These examinations can be invaluable at a scene to assist the investigators in determining the positions of perpetrators and victims and to give some indications of how the events unfolded. This work is tedious and time consuming but very rewarding.

During 2006, the Crime Scene Team responded to 60 requests for assistance which included 47 homicide and death investigations, six officer involved shootings, two criminal sexual assaults, three assaults and two kidnappings. A total of 26 vehicles were also processed, primarily in the BCA garage facilities.

In 2007, the BCA will continue to enhance its crime scene response abilities through continued training and testing of its members. The team will maintain its goals of providing Minnesota law enforcement agencies with the highest quality of crime scene processing and forensic analysis.

Interesting case:

In 2006, the BCA Crime Scene Team responded to the shooting death of a woman in a home in Chaska, MN. The team found the body of a woman lying on the floor in front of a closet door. Observation of the floor, walls and surrounding area indicated the woman had been shot once. Shooter and victim positions became an important element and these general positions were determined by evaluating both bloodspatter and shotgun pellet trajectories.

Embedded pellet locations were marked with green stickers. This isolated an area of pellet patterns indicating the possible direction of travel and blue strings were used to project their possible flight trajectories. Limiting angles were also used to approximate the possible flight trajectories. These results were carefully evaluated because impact may have caused pellets to deflect and alter their flight paths. The results however were compared to bloodspatter interpretation in an effort to substantiate a general locale.

During the bloodspatter examination on the closet door, it was determined that the "area of convergence" was consistent with the trajectories of the pellets observed in the far wall. Two general conclusions were made:

1) A bloodspatter impact area was found to be approximately 40-53 inches from the floor and approximately 3-5 inches out from the wall along the left side of closet door near the middle hinge area.

2) The flight trajectories of pellets appeared to travel along a hallway wall in front of the closet door in an upward direction toward the hallway ceiling.

During expert testimony offered at trial, a broad statement was made indicating the possible location of the shooter.

Drug Chemistry

The Drug Chemistry section is composed of twelve scientists; seven full-time and two part-time located in Saint Paul and two full-time and one in-training in Bemidji. The primary responsibility of the Drug Chemistry section is to analyze items of evidence for the presence of controlled substances. The items of evidence are usually submitted as powders, rock-like material, drug paraphernalia, plant material, tablets and/or capsules (clandestinely or legitimately manufactured), and liquids. The Saint Paul Drug Chemistry section received 2,935 cases in 2006 and was able to make a positive impact in the backlog by reporting out 2,988 cases. The Bemidji Drug Chemistry section received 1,154 cases in 2006 and reported out 1,034 cases.

Methamphetamine continued to be the most prominent controlled substance reported at both locations. Of the 4,510 items submitted for analysis in Saint Paul, 2,173 items were reported as containing methamphetamine. Of the 1,699 items submitted for analysis in Bemidji, 825 items were reported as containing methamphetamine. Cocaine was once again the second most reported controlled substance at 25.3% in Saint Paul and 23.0% in Bemidji. Both laboratories had an increase of reported cocaine items from 2005; a 4.1% increase in Saint Paul and a 7.8% increase in Bemidji. Simply stated, approximately 75% of the caseload for both Saint Paul and Bemidji is methamphetamine and cocaine.

In the midst of the methamphetamine and cocaine items, the laboratories analyzed cases containing other controlled substances. Other prevalent controlled substances within the section included marijuana, amphetamine, methylenedioxymethamphetamine (MDMA or commonly known as Ecstasy), psilocin (the active substance in psychoactive mushrooms), khat, and heroin. Pictured below are some items analyzed by the Saint Paul laboratory in 2006.

Chocolate covered mushrooms

MDMA (Ecstasy) tablets

Dried khat leaves (Graba)

The Drug Chemistry section has three primary goals for 2007. The first goal will be to expand our offering of preliminary reports. This offering provides prosecutors with preliminary identification and weight within two weeks of the submittal date. If the case is scheduled for court, then further confirmatory analyses will be performed. If preliminary examinations do not reveal the presence of either methamphetamine or cocaine, confirmatory analysis will be done. The St. Paul laboratory will begin its second year of preliminary reports with Stearns County and will expand to Benton and Freeborn Counties in early 2007. Bemidji currently offers a similar service to Itasca County. The second goal will be to increase the number of counties which utilize videoconferencing when our testimony is needed. Although it is an important part of our job, testifying can take us away from the laboratory for many hours if not days, so videoconferencing alleviates travel and miscellaneous time associated with testifying. Our third goal is to maintain the level of service our customers currently receive and to reduce the overall case processing time to 1-month. With the continued hard work of the current eleven scientists and the third scientist in Bemidji to be online soon, a 1-month turn around time should be manageable. All of these goals represent the section's understanding of how important timely results are for the investigation and prosecution of controlled substances. We are hopeful with the collaboration of our customers, these goals will be attainable.

Firearms and Toolmarks

There are three trained firearm examiners in St. Paul. One of the examiners has been on maternity leave for the last five months of 2006; she will return from leave in July, 2007. A part-time technician has been added to Firearm and Toolmark Section to assist the firearm examiners.

The Firearms and Toolmarks Section conducts tests on bullets, cartridge cases and firearms, restores serial numbers on firearms and vehicles, and identifies tools used to make unknown toolmarks. A comparison microscope is used for many of the examinations in the section.

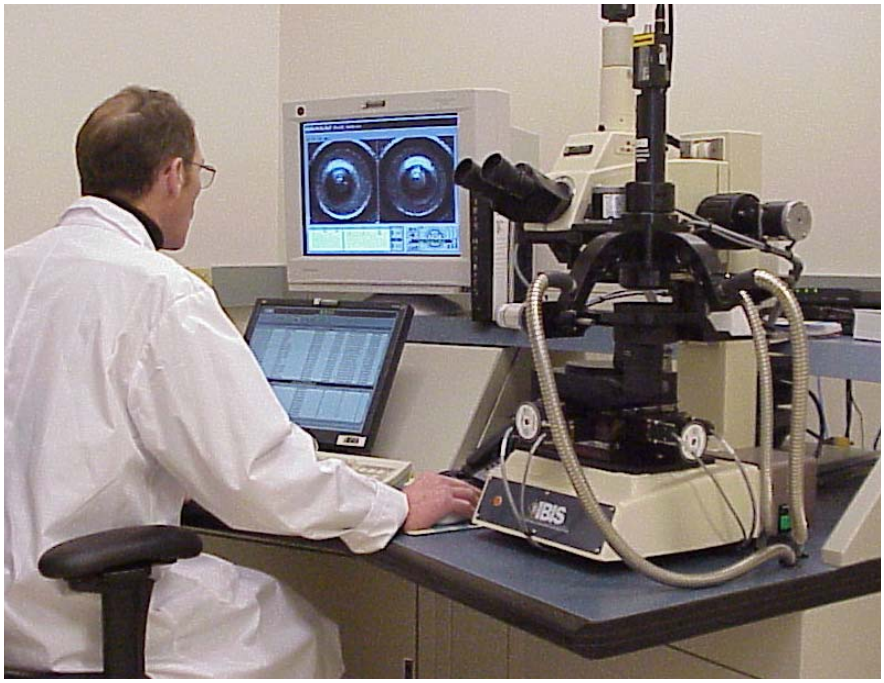
The Firearm Section is unique from the other laboratory areas in that they require extensive collections of reference firearms, ammunition, books and literature. These collections are used constantly in their examinations. The firearm collection is used in part for law enforcement or training purposes, for serial number location and structure, making inoperable guns functional to allow them to be test fired, and for disassembly and comparison to evidence guns. The ammunition collection is used to test fire firearms submitted and to assist in determining information (like brand or caliber) on evidence ammunition components. The Firearm Section in St. Paul has total of over 4500 reference firearms and approximately 75,000 rounds of ammunition.

The Firearms Section of St. Paul, in 2006, experienced a significant rise in the case backlog with the resulting turn around time of the submitted cases increasing by more

than 50% from 2006. The average turn around time for the St. Paul Firearms Section was greater than 44 days.

The majority of cases submitted to the Firearm Sections in 2006, continues to be NIBIN cases. The NIBIN program (National Integrated Ballistic Information Network) is sponsored by the BATFE (Bureau of Alcohol, Tobacco, Firearms and Explosives). This is a computer database program that captures images of fired cartridge cases and bullets that are recovered from crime scenes or are test fired from recovered firearms. When new entries are made into the database, the program compares the images and shows the scientist possible matches. The scientist must then acquire the actual evidence and make comparisons to verify whether a match or "hit" exists.

In 2006, the BCA entered 634 bullet or cartridge case images into the St. Paul database resulting in 39 "hits". This indicates that approximately 6 % of the evidence entered into the database is linked to another shooting or to a firearm. Many of the linked crimes or guns were between different law enforcement agencies.



Viewing images entered into the NIBIN database

2006 was an active year for courtroom testimony on firearm cases. The three firearm examiners in St Paul testified 27 times, throughout the entire state. The average total time for each appearance in court was 6 ½ hours.

Forensic scientists in the Firearms and Toolmarks Section participated in training and continuing education activities: one scientist was able to attend the annual AFTE Training Seminar and the scientists were able to attend several armorer courses.

Scientists in the section taught Firearms and Toolmarks Evidence Collection courses and a Serial Number Restoration course for Minnesota law enforcement personnel. These courses were coordinated by the BCA Police Training Section.

The St. Paul Laboratory continued training a firearms examiner for the Hennepin County Sheriff's Office.

Looking ahead to 2007, the Firearms and Toolmarks Section is looking forward to better serving the law enforcement community by providing training and reducing the turnaround time of cases. And, as always, the section hopes to find time to conduct research related to the firearms and toolmarks field in order to assist other firearm examiners, law enforcement agencies, and the criminal justice community.

Test firing a pistol into the bullet recovery tank

Questioned Documents

The Forensic Questioned Documents section offers examinations in such areas as handwriting and hand printing, typewriters, indented writing, ink, paper, mechanical impressions, photocopiers, alterations and obliterations, counterfeit documents, and the reconstruction of documents that have been burned or damaged. The section is presently staffed by two full time forensic document examiners, Shawn Gallagher and Lisa Hanson.

In August 2006, Lisa finished her certification process through the American Society of Questioned Document Examiners and is now officially a Diplomate of the American Board of Forensic Document Examiners. This certification process involved a written exam, five practical cases, and an oral review by the acting board members.

In 2006, the Questioned Document section saw an increase in Methamphetamine "book-keeping" cases and also, fraudulent Prescription Drug Form cases. Both types of cases involve many of the different forensic document examinations, ranging from handwriting to ink comparisons.

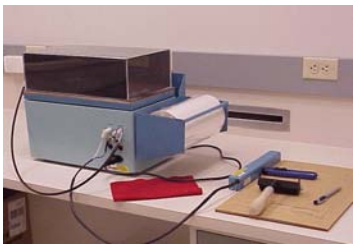
Forensic Document cases continued to involve mostly handwriting comparisons. The evidence itself can vary from paper to the proverbial handwriting on the "bathroom" wall. The original evidence is always preferred, but in some cases, high quality photographs must suffice. In the past, document evidence has been involved with homicides, bomb threats, money-laundering, and many other types of cases.

Identity theft cases are becoming common. These cases take more time because of the multiple examinations that need to be completed. It is possible that a handwriting examination, ink comparison, document authenticity examination, and printing process verification will be performed in order to complete an identity theft case. The task of the examiner is to identify the fraudulent documents that are produced using high tech forgery processes and to help the investigator find the beginning of the paper trail, if possible. The Bureau of Criminal Apprehension Forensic Document Lab has the latest innovations for document examinations.

Fig. 1 depicts the Imaging Laboratory which includes the VSC 2000 (the Video Spectral Comparator) used to differentiate between inks and for other scientific examinations. Figure 2 is the ESDA or Electrostatic Detection Apparatus. This instrument is used to detect and to lift indented writing images. Indented writing impressions can occur when paper is stacked or padded together and writing occurs on the top sheet(s) which leaves indented writing impressions on the sheet(s) below it.

Figure 1: The Imaging Laboratory

Figure 2: The Electro Static Detection Apparatus



The cases submitted to the Forensic Document Section continue to represent a wide spectrum of case types ranging from vandalism to homicide investigations. We would like to remind our clients, that in order for us to conduct a complete examination, we need the following materials:

1. If the original of the questioned and known documents exist, they are the preferred material to examine. If the originals are not available, we can work with photocopies provided they are of good quality.

2. If the case involves the forging of another person's writing and signatures, it is important to provide the victim's writing and signatures for elimination purposes. This helps us to make a determination whether the questioned material really is genuine writing or not and whether any attempt has been made to simulate or copy the victim's writing.

3. The writing from the suspect writer must be comparable to the questioned material. This means that we must have hand printing from the suspect writer if the questioned material is hand printed, and handwriting if the questioned material is handwritten. It also means that we need the same letter combinations in both the questioned and known material. It is not possible to compare a cursively written "Kate Jackson" to a hand printed entry of "John's TV Repair".

4. A general handwriting exemplar should be submitted from the suspect writer(s) if possible. It includes all the letter forms, both upper and lower case, as well as numbers. If you need handwriting exemplar forms, you may access them at the Bureau of Criminal Apprehension website: http://www.dps.state.mn.us/bca/lab/documents/Lab-Intro.html or call 651-793-2900 and they can be provided. The requested known writing should also consist of the same phrases and names as appear in the questioned material, besides what is requested in the exemplar. This material should be dictated to the suspect writer and repeated several times. The suspect writer should never be shown the questioned material and asked to copy it.

   In addition to the requested known writing, it is very important to include non-requested known writing from the suspect writer if at all possible. This consists of material which was written when the suspect writer had no idea that it would be used for examination purposes. This can help us determine whether the requested material on the exemplar is natural and fluent writing normally produced by the suspect writer. Suggestions for places to collect non- request writing are also on the web site.

Many investigators, when working with forged checks, often focus their efforts on determining whether the payer's signatures were written by their suspect writer and therefore only collect signature samples. Unfortunately, many forgers make an attempt to disguise the payer's signatures and this makes identification of the forger difficult. However, many times the forger makes little effort to disguise the writing in the date, memo, payee and amount areas. If comparable known writing is received, it is often possible to identify this material as having been produced by the suspect writer.

The QD section is always working to remain on the cutting edge of all new technology as the science of forensic document examination progresses into 2007.

Latent Prints

There were no shortages of casework for the Latent Print Section in 2006. One thousand two hundred seventeen (1217) latent print assignments were approved in 2006. This is an 18% increase in case output compared to 2005 (1035 assignments reported). The number of submissions between 2005 and 2006 were approximately the same (see Table 1). Approximately 100 cases per month are received by the Latent Print Section. Current average turn-around time for a latent print case is approximately 45-60 days.

Year	New Case Submissions	Cases Completed*
2003	881	851
2004	853	897
2005	1122	1035
2006	1151	1217

*Note: the number of cases completed can be higher than the number of new case submissions when there is carry-over from a previous calendar year.

Table 1-Trend of Increasing Case Load and Case Output

The high volume of case submissions is in part due to continued participation in a grant from the Auto Insurance Industry that focuses on the processing and analysis of auto theft cases. This was done by providing funding for training and equipment for law enforcement personnel throughout Minnesota. Scientists Scott Ford and Marty Koolen held seven classes demonstrating how to efficiently process vehicles and evidence to maximize the potential of recovering valuable latent print evidence from auto thefts.

One Basic Latent Print Course was taught in Fairmont and one Advanced Latent Print Courses was taught in Bemidji. These popular 3-day classes promote more pre-processed evidence and better quality latent print lifts and photographs that are submitted to the Latent Print Section by law enforcement agencies.

The MAFIN (AFIS) database is used to search unknown latent prints to known fingerprints that are entered into the system. This network contains the criminal fingerprint records for the states of Minnesota, North Dakota and South Dakota. The Latent Print Section also has access to IAFIS, which is the national database maintained by the FBI. Use of IAFIS resulted in 3 identifications from the national database in 2006. Sixty-five (65) suspects were identified last year in a variety of cases, including two robberies and two death investigations. In addition to these searches, approximately 300,000 fingerprint images from fingerprint cards entered daily in to the system were compared against latent images in the Unsolved Latent File, resulting in the identification of 31 suspects in previously unsolved cases (See Table 2).

Approx. Number of MAFIN searches	Number of Hits	Hit Rate Percentage	Approx. Number of MAFIN reverse searches	Number of Reverse Hits
900	65	7.2%	69,500 (equal to approx. 300,000 fingerprint comparisons	31

Table 2-2006 AFIS statistics

Of the 96 total hits provided by the combined AFIS tools, approximately 40% of the hits were in burglary cases, 10% in theft cases, and 10% in auto theft cases. Of the remaining 40% of the hits, these were distributed among forgery/fraud, controlled substance, robbery, death investigations, and other miscellaneous cases. In 10% of the cases, the case type was unknown.

Interesting AFIS cases included one where an unidentified deceased male was identified by Scientist Joshua Bergeron. In another of Bergeron's cases, a robbery case, he identified 3 separate individuals using AFIS. Scientists Gary Walton and Glenn Langenburg identified latent prints through AFIS on a letter bearing death threats sent to a judge in Worthington, Minnesota.

The Latent Print Section conducted a research study on the potential effects of contextual bias on expert opinion. This study was conducted live at the International Association for Identification (IAI) conference held in Boston, Mass. by Scientists Glenn Langenburg, Scott Ford, and with the help of a forensic scientist from Arizona DPS Forensic Laboratory, Pat Wertheim. The study was conducted through a grant obtained from the Midwest Forensic Resource Center (MFRC) in Ames, Iowa. Additionally, Langenburg, with co-authors Wertheim and Moenssens, published an error rate study of latent print comparisons in the *Journal of Forensic Identification*.

An interesting Minnesota legal challenge occurred for latent print identifications in a Hennepin County Sheriff's Office burglary case. A defense attorney for the Hennepin County Public Defender's Officer challenged the admissibility of fingerprint evidence, stating that the science and reliability of the conclusions has not been tested and therefore not admissible. A Frye-Mack hearing was held in May. Diane Nelson, a Hennepin County Latent Print Examiner testified to her evidence, policies, and procedures. Dr. Simon Cole, a professor at the University of California, Irvine, Calif. and well-known critic of fingerprint science testified for the defense. Scientist Glenn Langenburg was asked by Hennepin County Prosecutor's Office to assist in the trial preparation and provide rebuttal testimony. The court ruled in favor of admitting the fingerprint evidence. However, the Public Defender's Office has made it clear that they will continue to challenge the admissibility of the comparative identification sciences.

Scientist Marty Koolen was very involved in the review of vendor bidding for an AFIS upgrade. Koolen traveled to several sites in the U.S. to see various AFIS systems at work and rate their performance. Ultimately this valuable scouting report was useful in the decision by the MAFIN board and CJIS to choose Motorola as the vendor to support a new, upgraded MAFIN. Conversion and installation of this system will occur in 2007.

Koolen also attended the Motorola User's Conference in Anaheim, Calif. to learn about the capabilities of the new technology we will be receiving.

Scientist Glenn Langenburg was promoted to Lead Technical Scientist of the Latent Print Section last year. Scientists Marty Koolen and Josh Bergeron attended a week long Adobe Photoshop training course in Ames, Iowa. Bergeron also presented lectures and a workshop for the Midwestern Association of Forensic Scientists and the Indiana Division of the International Association for Identification in Indiana in October. Langenburg traveled to Lausanne, Switzerland, under the MFRC grant to conduct statistical analyses of the data collected from his bias study. The tests were conducted at the University of Lausanne, where Langenburg is pursuing a Ph.D. in Forensic Science.

Perhaps most importantly, the biggest change comes from the addition of a new scientist, Dennis Randall, to the Latent Print Section. Randall, a Certified Latent Print Examiner and who previously had over 25 years experience with the Hennepin County Sheriff's Crime Lab, brings a wealth of knowledge and experience to add to the BCA Latent Print Section. His enthusiasm for case work is very noticeable and he has been instrumental in reducing our backlog.

New Scientist Dennis Randall hard at work in the latent print laboratory

Support Services

The primary focus of the Support Services group is to provide the laboratory with assistance in day-to-day activities, which affect all scientific sections of the laboratories in St. Paul and Bemidji. Areas that make up this section include quality assurance, safety and training, laboratory information system management (LIMS), evidence intake, administrative support, purchasing, photo/imaging, and our newest addition, DNA offender sample intake and tracking.

Quality Assurance

Work conducted by the Minnesota BCA Forensic Science Service is of the highest quality possible to meet the needs of the criminal justice community. Laboratory Quality Assurance programs are designed to provide a quality system to demonstrate that results are accurate, impartial and relevant. The laboratory quality system is designed to meet or exceed the requirements for laboratory accreditation established by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). The Bemidji Laboratory and St. Paul Laboratory both maintain separate accreditations by ASCLD/LAB. The laboratory quality system functions to evaluate laboratory methods and procedures, case files, staff technical competency and proficiency, and to document these evaluations through laboratory internal quality auditing, quality assurance reporting, and quality assurance reviews.

Laboratory internal quality control audits are one aspect of laboratory Quality Assurance. The audits are conducted yearly for the St. Paul Laboratory, and for the Bemidji Laboratory. The laboratory has many members who have had formal training in Quality Assurance auditing given through ASCLD/LAB, the FBI, or through the College of American Pathologists. In 2006, these expert auditors were utilized within the laboratory to complete the annual internal quality control audits of each of the laboratory sections, and laboratory support services. By having this large pool of talent, coordinated by laboratory Quality Assurance, the laboratory was able to spread out the work, and maintain independence of the auditors. This is only one example of laboratory Quality Assurance coordination of resources to maintain laboratory quality.

Safety and Training

The Safety and Training program for 2006 continued to be involved in the following areas: bio-hazardous wastes, chemical safety, respiratory protection, safety audits, and various training areas such as courtroom testimony, crime scene, right-to-know, evidence handling, and general lab operations.

Other areas of involvement include:

- Citizen's Academy – this academy educates business leaders in the community and shares the capabilities of the BCA to enhance community confidence.

- Forensic Partnership Program – This program links Medical Examiner staff with the BCA in an effort to educate death investigators throughout Minnesota. Investigators receive training in crime scene processing techniques and in the capabilities of the forensic laboratory.

- Internship Coordination – The BCA laboratory has an extensive internship program available to qualified undergraduate and graduate students. The coordination of this program involves overseeing the entire application and interview process.

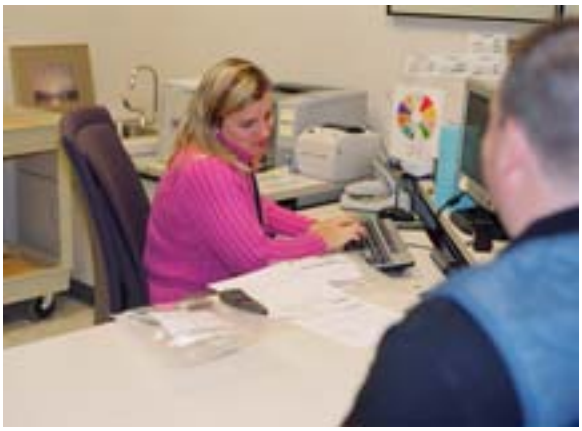
Laboratory Information Systems Management (LIMS)

The laboratory computer evidence tracking system allows for quick and accurate organization of laboratory case information and records. This system is constantly evaluated and maintained. The BCA system incorporates auto e-mailing to law enforcement agencies and access to report information by departments through secure access to the BCA lab report website at: https://BCALAB.dps.state.mn.us/BCALAB

This decreases laboratory turn-around times and allows departments to access reports via their own computers. Currently, about three hundred Minnesota law enforcement agencies have access to this site.

Several changes designed to increase the efficiency and effectiveness of our case management system were incorporated during 2006.

Evidence Intake



In 2006, the BCA Laboratory added 2 new full-time positions to the evidence intake staff. This will assist the Laboratory by providing more effective evidence intake coverage. Our Forensic Evidence Specialists gather information on cases submitted, take in the evidence through our Laboratory Management Information System (LIMS), direct it to the appropriate sections and return the evidence when all examinations are complete. They also serve as a liaison between sections and agencies in answering questions that assist investigators with case analysis. This is a very important role in that it helps maintain communication between the analysts and the investigators and affects the overall quality of analysis.

Evidence Specialists also develop film for the Minnesota State Patrol and purchase all supplies, chemicals and equipment for the laboratory.

Administrative Support

Case files are maintained, organized and filed by our Administrative Support section, as well as information from phone messages, e-mails and faxes. The laboratory receives numerous calls and requests and our Administrative Support Team ensures that they are correctly routed and that our scientists receive the information.

Photography/Imaging

The photo/imaging section develops film, digital media and prints photographs for the BCA and the Minnesota State Patrol. When photos are requested, CD's in jpeg format are produced and sent to law enforcement agencies. Law enforcement agencies can request enlargements and reprints through the laboratory photography section.

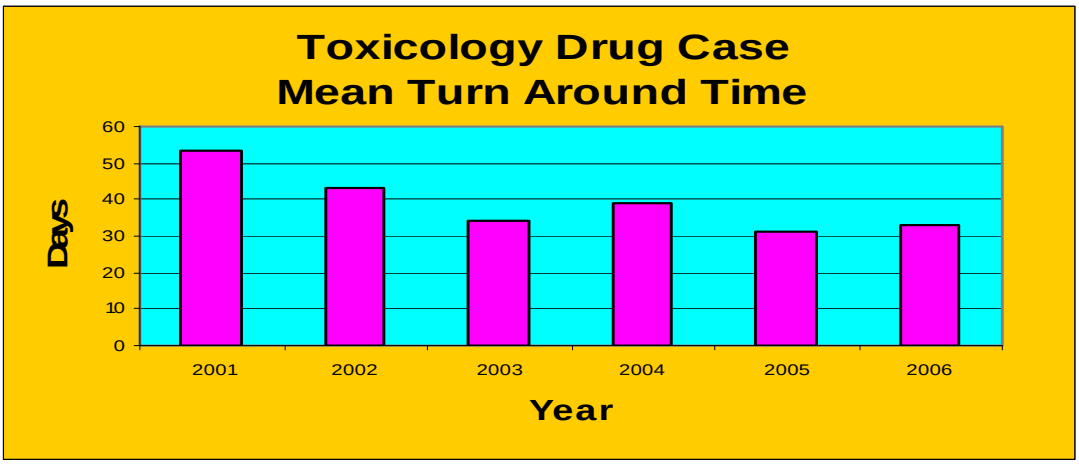
If departments use digital formats for taking pictures for laboratory exams, CD's with photos can be sent to the laboratory for development. Examples of photographs may include but are not limited to fingerprints, shoeprints, and tire tracks. Enlargements are also made for court purposes.

DNA Offender Sample Intake and Tracking

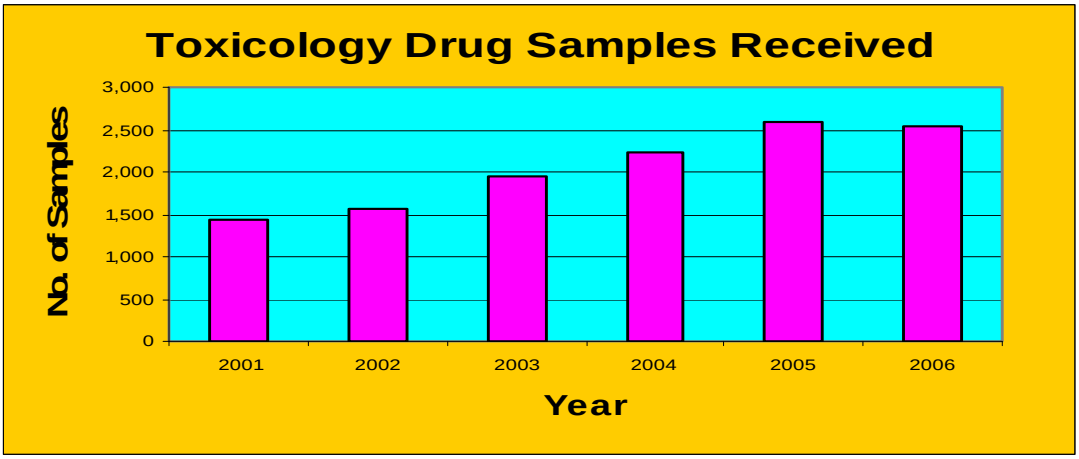
Criminal Intelligence Analysts (CIA) receive DNA samples, enter, and track convicted offender samples submitted to the laboratory. When the samples are received, they are split, read for sample quality/validity, and entered in the CODNA program and CODIS database. The CIA's then track the progress of various criminal proceedings.

Toxicology

In 2006, the Toxicology section analyzed 6489 blood and urine samples for alcohol from 6,002 cases, and 2549 samples for drugs from 2,158 cases. Of these samples, 5871 were from arrests for driving while impaired (DWI), the rest were from felony cases and death investigations.



After alcohol, marijuana was the most common drug found, followed by methamphetamine, benzodiazepines (diazepam, lorazepam, etc.), cocaine, opiates, and other drugs. The number of positive tests continues to increase for sedative/hypnotics such as zolpidem (Ambien®) which can cause severe impairment of driving-related skills, as well as anti-depressants, such as citalopram and sertraline, which can cause impairment, especially when mixed with alcohol.



Newly appointed and experienced judges received training on *Alcohol and the Intoxilyzer* last year, and we served as instructors for various attorney groups and at area universities and colleges. During 2006 Toxicology staff attended workshops and scientific sessions at the annual meetings of the Society of Forensic Toxicologists and the American Academy of Forensic Sciences as well as the Effects of Drugs on Human Performance course presented by the Indiana University Robert F. Borkenstein Center for Studies of Law in Action.

Our most interesting case this year involved a suspected methamphetamine user who was found in possession of a large container filled with the individual's own urine. Since up to 43% of a dose of methamphetamine is excreted in the urine within 24 hours of methamphetamine ingestion, investigators believed that this person was collecting urine in order to extract the methamphetamine for future use. And as it turned out the urine sample tested positive for the presence of methamphetamine.

Trace Evidence

Chemical Testing

During the last year, the Trace section saw a 27% increase in chemical testing casework from 159 in 2005 to 219 in 2006. The number of items per case did fall from 3.8 in 2005 to 2.8 in 2006. Turn around time for the year has remained below 30 days for fire debris samples. For six and a half months of the year, there was only one analyst in the section.

We did have two interns this summer. Mark Groth came to us from Wisconsin, where he had been interning and attending as an undergraduate. The experience that he had in Wisconsin on the use of Solid Phase Micro-Extraction (SPME) was put to use in the chemical testing section as we continue to develop methodology on the use of SPME in automated fire debris analysis. Good agreement was achieved between samples using SPME and those using traditional methods. This method could possibly be in general use within a year.

SPME is a solvent-less extraction technique. This would eliminate the use of solvents, such as, carbon disulfide and pentane, which have health and environmental concerns. SPME could be used as a screening method thus cutting down or eliminating solvent consumption in the laboratory.

Ashley Woodford was our second intern with a project on vegetable oils in fire debris. This was an entry level project, since this is still a developing area of investigation. At this year's annual meeting of forensic scientists, a workshop is being held on vegetable oils in fire debris. This is a difficult area with extractions quite different than those usually used in the arson area. As methods develop, we hope to have this analysis on-line within two years.

Microscopy

Case Statistics: The trace evidence section reported out 124 microscopy cases in 2006. Twenty-three cases were Trace-Mitochondrial hair examinations. The break down for case type is shown in Figure 1. Turn around time has decreased from an average of 189 days in 2002 to an average of 97 days in 2006. This drop is due largely to the presence of a retired scientist who has stayed on while newer scientists gain experience and complete training modules.

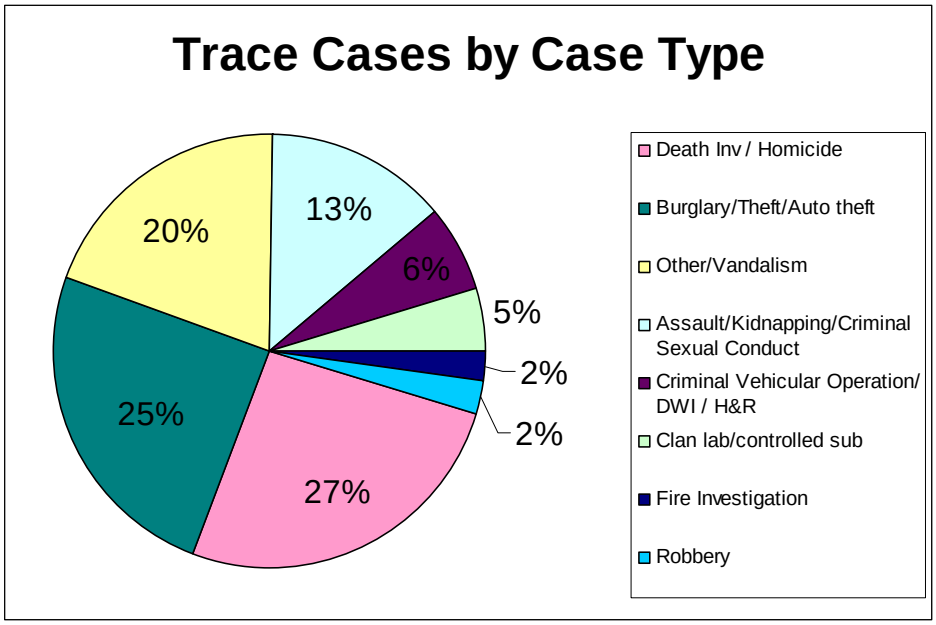


Figure 1 Breakdown of case type analyzed in Trace

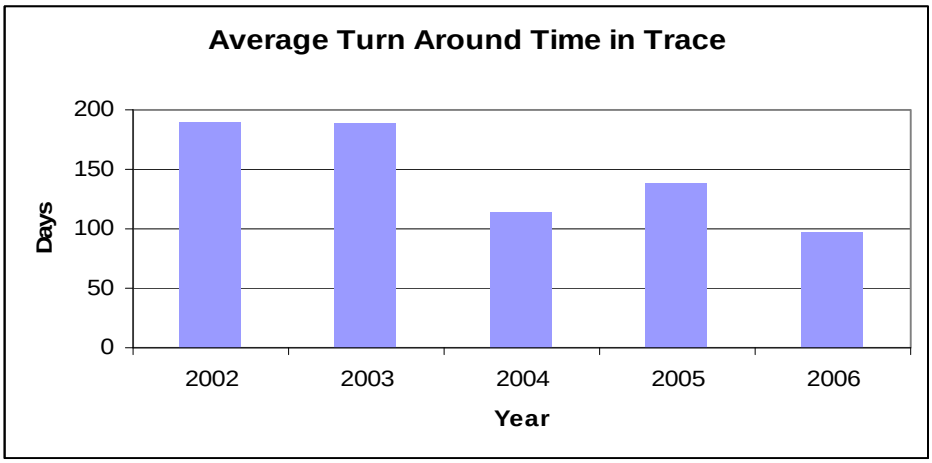


Figure 2 Turn around time

Staffing: Following the return of one scientist from maternity leave in August, the section consisted of four scientists – two of which are designated as hair examiners. The section supervisor also continues to do casework.

Unusual Case: Some broken glass was submitted to the Trace Section. Investigators wanted to know if the glass was once a Jose Cuervo tequila bottle. The glass fragments were re-assembled and compared to an intact tequila bottle. Physical features of the glass were found to correspond between the two glasses. In addition, etched lot numbers in the same format were found on both bottles. Subsequent phone calls to Jose Cuervo confirmed that these numbers refer to the date and plant where the contents were bottled.

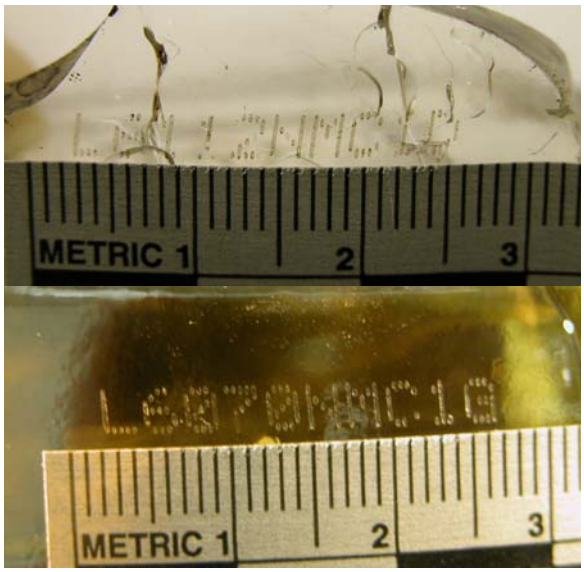


Figure 3 Top: Broken glass from arson scene with etched lot numbers. Bottom: Jose Cuervo bottle with an etched lot numbers

Training: The Trace Section has reactivated microchemical tests. These tests had been used years ago, but had fallen into disuse. Thus training had not been conducted for several years. Training took place in November and December for the entire section.

Microchemical tests encompass wet chemistry which is performed on a microscope slide or spot plate. The resulting reaction typically produces crystals which are viewed microscopically and are characteristic for a particular compound. In some cases effervescence or fine precipitates are observed.

Microchemical tests are generally used as preliminary exams or in conjunction with instrumental exams. For instance, analysis by SEM-EDS may demonstrate that calcium is present in a substrate, but microchemical tests can determine if the calcium is present as calcium oxide or calcium carbonate. Likewise, microchemical tests can differentiate between nitrate and nitrite or the oxidation state of iron. The tests are generally quick and require only a few grains of the substance. The Trace Section is very pleased to add this to our arsenal.

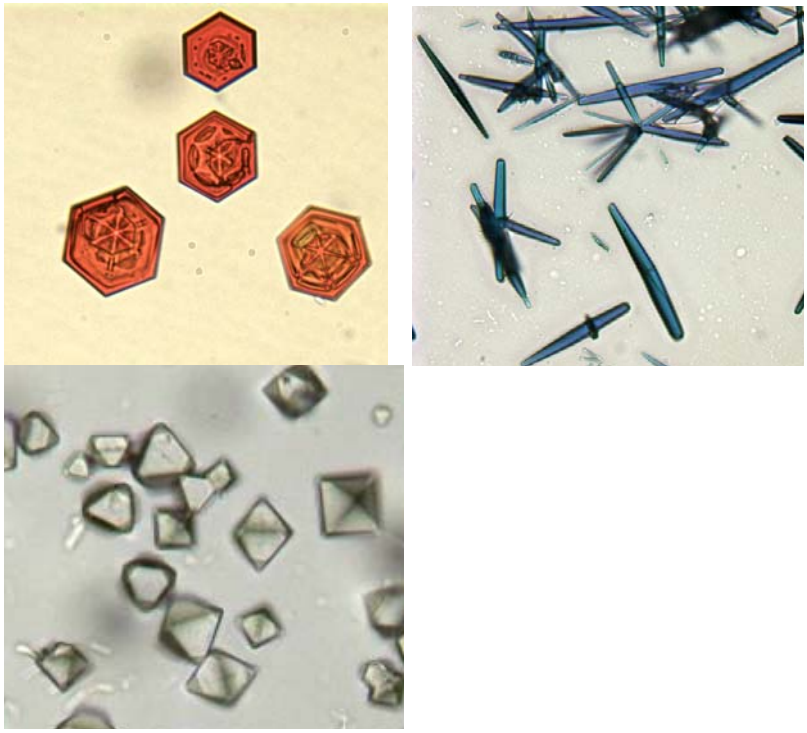


Figure 4 Some crystals observed. Top Left: Bismuth reacted with cesium chloride to produce $2BiCl_3{\cdot}3CsCl$ at 600X, Top Right: Cobalt reacted with Mercuric thiocyanate to produce $CoHg(SCN)_4$ at 400X. Bottom Left: Tin reacted with cesium chloride to produce Cs_2SnCl_6 at 400X.

Two scientists completed training in the paint discipline in 2006. This discipline is one of the longest in the trace section and requires the use of most of our instruments. Congratulations to the two scientists! Two scientists are in the midst of training in the fiber discipline – another lengthy training regimen. Although, we refer to it as “fibers,” fiber exams cover all fabrics and textiles, ropes, knots and cordage, damage to textiles such as cuts, tears and burns as well as the hardware associated with clothing such as buttons and zippers. One scientist is training in shoe print and tire track examinations – the third of four lengthy sub disciplines.

Trace scientists were able to attend a two-day class on Fourier Transfer Infrared Spectroscopy (FT-IR class). Two scientists attended a Courtroom Testimony class sponsored by the Midwest Forensic Resource Center (MFRC). One scientist attended a one week class on textiles and fibers at Cedar Crest College in Pennsylvania. Two scientists attended the Midwestern Association of Forensic Scientists (MAFS) annual meeting where they heard a variety of talks and attended workshops. All classes received good reviews.

Research and Presentations: Multiple presentations were given by trace scientists to law enforcement, to higher education and at professional meetings. Presentations of interest included "Tinkering with Glitter" presented at the Scientific Working Group for Materials (SWGMAT) meeting in March, 2006; "Fabric Damage: Cuts, Tears, Burns, Etc" presented at the Midwest Forensic Resource Center (MFRC) Trace Symposium in June, 2006; and "Examination of Absorbance Microspectrophotometer to Differentiate Between Automotive Clearcoats Deemed Similar by FT-IR" was completed and presented by an intern at an all lab meeting. One scientist taught an extension course at the University of Minnesota.

Instrumentation and Software:

Due to strong demand for the comparison microscope from our hair examiners, an additional comparison scope was purchased. It has a phototube that allows pictures to be taken of materials on the microscope slide – a requirement for hair exams and other trace exams. A polarizing light microscope was also added to the lab.

Figure 5 Comparison Microscope

The Trace Section added Microsoft Publisher in 2006. It has been heavily used to create professional looking court displays, posters and flow charts. Displays can be printed up to 40 inches across and infinitely tall from rolls of glossy or regular paper.

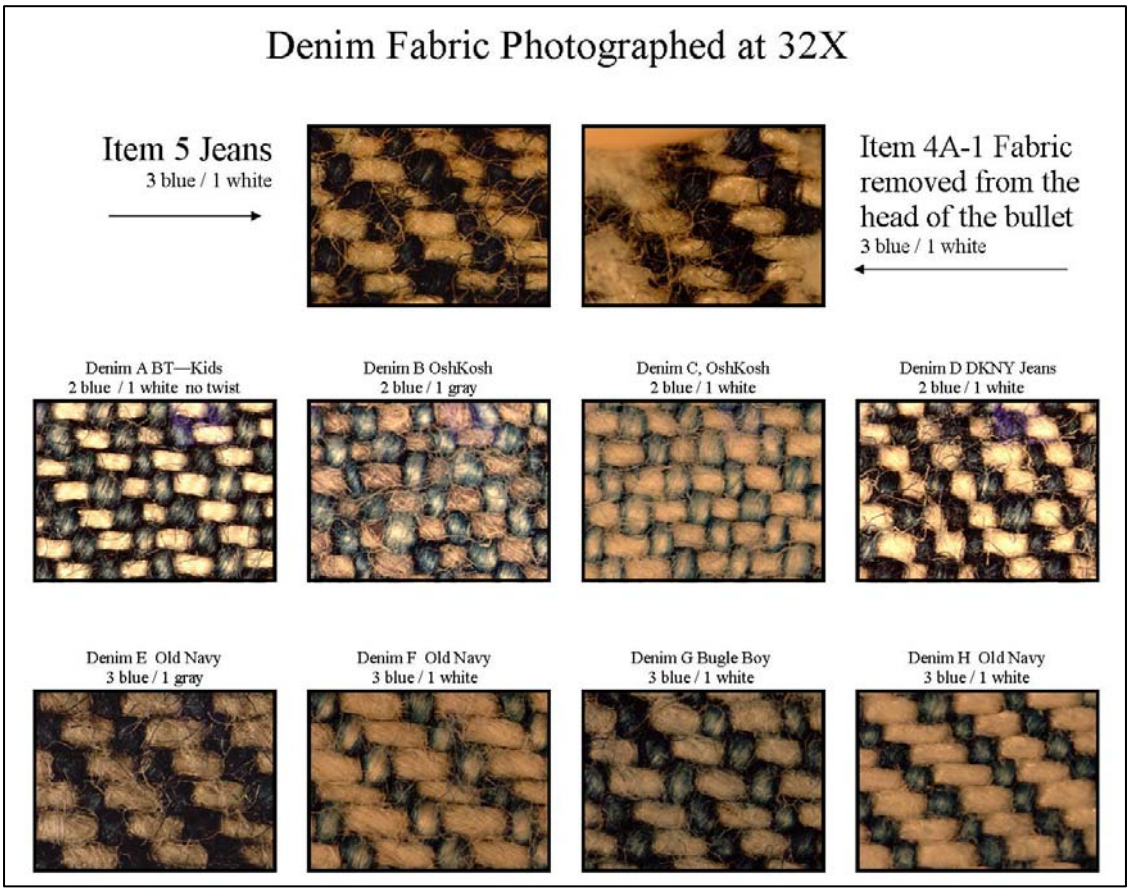
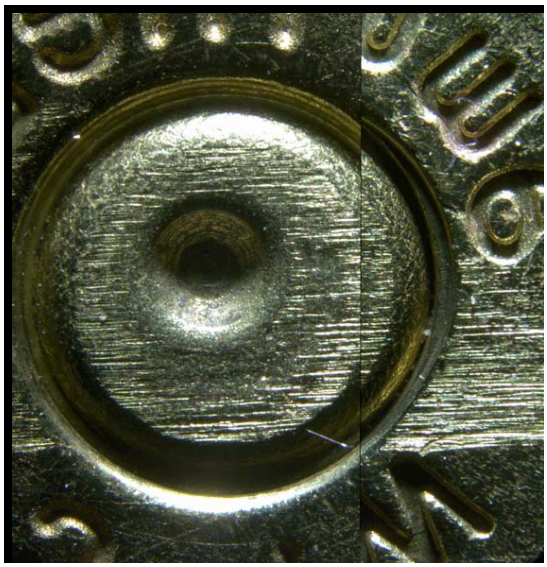


Figure 6 Court display made in Microsoft Publisher showing the difference of denim blue jeans when observed though a stereoscope

Firearms and Toolmarks



Cartridge Case Comparison

The Firearms Section is staffed with one Firearms Examiner and a part time Database Technician. Funding for the Database Technician is provided through the federal Project Safe Neighborhoods grant, and the position is filled by retired Senior Special Agent Mike O'Gorman. In addition to clearing nearly 140 cases, the section has been actively promoting the National Integrated Ballistics Identification Network (NIBIN), a national firearms database sponsored by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATFE). Approximately 300 entries were made into the firearms database and promotional and educational training was provided at several of the larger law enforcement agencies in northern Minnesota. The section further contributed to the forensic community by training a Firearms Examiner for the South Dakota DCI Forensic Laboratory, a two year program, as well publishing an article in the Association of Firearms and Toolmark Examiners Journal.

Drug Chemistry

Bemidji's Drug Chemistry Section is staffed with three scientist (two fully trained and one in training) and they completed over 1000 cases last year. As in St. Paul, methamphetamine continues to be the most frequent submission with cocaine coming in second. The section noted a near elimination of cases involving clandestine methamphetamine manufacturing facilities, but the decrease in methamphetamine labs

did not stem the flow of methamphetamine into the laboratory and the product submitted showed an increase in purity. The section saw a variety of other drugs, including hallucinogenic mushroom spores, which had to be successfully grown to prove what they were, and several other designer drugs. In one case involving both state and federal agencies in the United States and Canada, approximately 37 pounds of Ecstasy were submitted for analysis in 23 bags containing approximately 46,000 tablets. In addition to the heavy case load, the section promoted forensic science through training and classes at schools and universities and provided training to law enforcement agencies in Minnesota.

Lots of Marijuana

Latent Prints

With two trained examiners and one trainee position, the Latent Print Section was able to report on nearly 300 cases last year. A new part-time position was filled by retired Senior Special Agent Steve Hagenah, who is assisting the examiners by processing and documenting items submitted for analysis – a huge time saver for the examiners. Additionally, over 100 latent prints were entered into the Minnesota Automated Fingerprint Identification Network (MAFIN). 10 hits resulted from these MAFIN entries.

In one success story, an officer and graduate of the BCA Basic Latent Print School recovered a print from items in a stolen vehicle. The print was located through standard powder processing. Its location, however, required the use of silicone based casting material to lift the print for analysis. The resulting lift, while appearing to be of marginal quality to the officer, was submitted to the laboratory. The print was entered into MAFIN which lead to the identification of an individual who was involved in numerous other criminal investigations. Both the techniques used to obtain the print and the decision to send the print to the laboratory, a print that the officer previously would have dismissed as unsuitable, were credited to the training the officer received in the Basic Latent Print School provided by the laboratory.

Fluorescent Enhancement

The Latent Print Section continues to provide training to the law enforcement community of northern Minnesota through both Basic and Advanced Latent Print Schools, auto theft training and evidence recognition and processing classes.

Biology/Nuclear DNA

Bemidji's DNA Section was short staffed throughout most of 2006. Even so, with the help of the St. Paul Nuclear DNA Section, over 400 Serology/DNA cases submitted to the Bemidji Laboratory were analyzed. By years end, the staffing levels were restored to the original number and we are looking forward to examining more DNA cases in the Bemidji Laboratory during 2007.

Crime Scene Response

The Crime Scene Team provided assistance in the processing of crime scenes to law enforcement agencies in northern Minnesota over 20 times last year. With the smaller number of staff in Bemidji, all scientists are trained to provide crime scene processing services. One of the focuses of our continuing education for 2006, both in Bemidji and St. Paul, was in bloodstain pattern analysis. Training and testing was provided to virtually all team members.

Luminol Reaction to Bloodstain

One major milestone for the section, and the lab as a whole, was the completion of analysis of evidence in the investigation of the death of Dru Sjodin. This case began with Dru's abduction in November of 2003 and continued with the recovery of her body in April of 2004. Countless hours of work went in to the analysis of evidence and involved not only the Crime Scene Section, but the Latent Print Section and the Nuclear DNA and Trace Sections in St. Paul. Additional analysis was performed by the Mitochondrial DNA Section of the FBI Laboratory. The case finally went to trial this fall. While the appeals process continues, the trial phase represents the completion of a large and high profile case through dedication and long hours of analysis by many scientists in the laboratory.

Paul and Babe Go Ice Fishing on Lake Bemidji