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ANNUAL REPORT 2009

Inside this issue:

ASCLD/LAB-*International* accredited since December 10, 2009

Message from the Laboratory Director

On December 10, 2009 the two Laboratories of the BCA were accredited under the ASCLD/LAB-*International* accreditation program. Why is that important to the criminal justice community? It is an affirmation of the quality of all aspects of the BCA's forensic science services. I would like to recognize the concerted effort by our Quality Manager Debra Springer in shepherding both laboratories through the accreditation process. Our quality coordinators Mohamed Sedqi and Mark Nielsen along with many of our scientists and supervisors toiled for over a year in preparation. ASCLD/LAB-*International* is an ISO-PLUS Program of Crime Laboratory Accreditation, ISO/IEC 17025 enhanced by ASCLD/LAB-*International* Supplemental Requirements. For more information on the accreditation program visit http://ascld-lab.org/

Frank C. Dolejsi, Director

Mitochondrial DNA Section

The Minnesota Bureau of Criminal Apprehension received funding from the FBI to operate a regional mitochondrial DNA laboratory. After about one year of lab set up, training, and validations, the MN BCA went online with national coverage for mitochondrial DNA testing in the fall of 2005. We find ourselves four years later with a long list of accomplishments, several success stories, and an expansion of the section on the horizon. Cases that the mitochondrial DNA section currently works on are typically homicides, kidnappings, and sexual assaults. We also do several cold cases, unidentified human remains, missing persons, and identity confirmations. The types of samples that we work with are most commonly hairs, bones, teeth, preserved tissue, blood, and saliva.

In 2009, 118 cases were submitted through our cooperative agreement with the FBI. Cases are received from local law enforcement agencies from all over the state of Minnesota, as well as, cases that come from agencies all over the country.

Skull for mtDNA Analysis

Cold Case Assisted with mtDNA

Cases received this year consisted of the following:

- Death Investigations—9
- Missing Persons—22
- Homicides—22 cases
- Criminal Sexual Conduct—9
- Unidentified Human Remains—11
- Kidnappings—2
- TEDAC—41
- Robbery—1
- Assault—1

Mitochondrial DNA is maternally inherited

What Is Mitochondrial DNA?

Mitochondrial DNA (mtDNA) is found inside an organelle called a mitochondrion which are located in the cytoplasm of the cell. The mitochondria are responsible for providing the cell with most of it's energy. Because there are several copies of mtDNA per cell, most of the evidence received by our laboratory consists of items that are most likely old, degraded, or of limited sample amount. Unlike the biparental inheritance of nuclear DNA, mtDNA is inherited maternally. This means that all relatives along the maternal line will share the same mtDNA profile. Because of this characteristic, mtDNA is a powerful tool in that a maternal relative can be used as a reference sample. This has been especially helpful in solving missing persons and unidentified human remains cases.

Why Mitochondrial DNA?

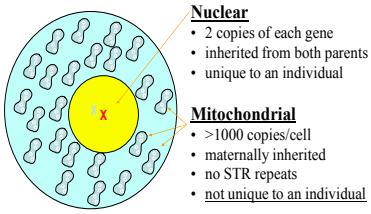
Advantages of using mtDNA for forensic analysis:

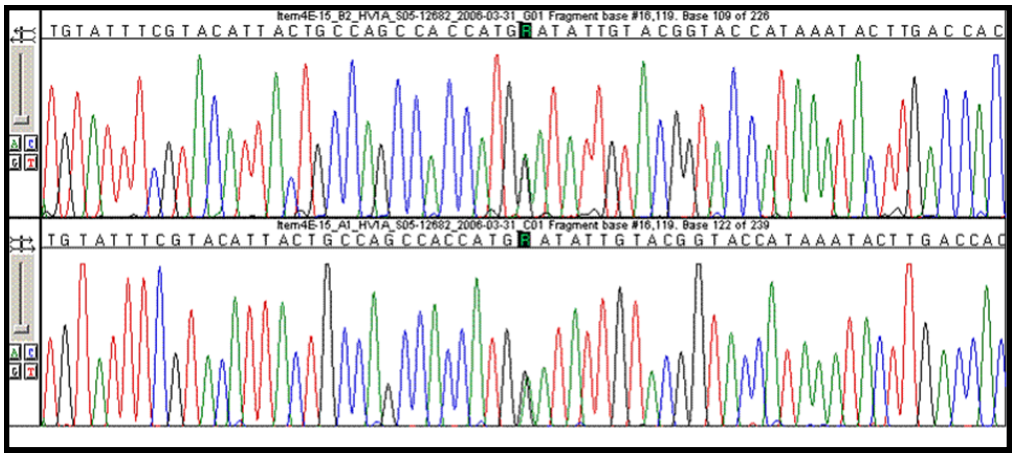
- Many copies per cell
- Less prone to degradation
- Highly variable between unrelated individuals
- Maternal inheritance—

  which means that a maternal relative can be used in lieu of a known sample

Keep In Mind: Unlike nuclear DNA, mitochondrial DNA is not unique to an individual.

Where is the DNA found?





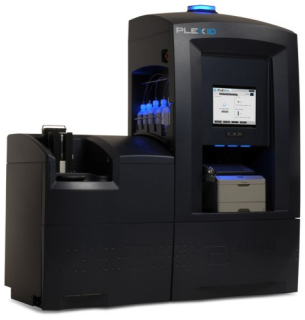
DNA Sequencing Data

Currently there are 7 scientists assigned to the mitochondrial DNA section: 1 supervisor, 2 examiners, and 4 biologists.

New Addition to the Mitochondrial DNA Section

The mitochondrial DNA section is excited to announce that sometime this spring, it will receive a new instrument called a mass spectrometer. It is a PLEX-ID System which combines PCR with high precision electro-spray ionization mass spectrometry. A mass spectrometer interprets haplotypes using base composition.

We are lucky to receive such an instrument, as not very many laboratories are currently using this type of technology for forensic DNA analysis. It is being funded by the Federal Bureau of Investigation.



Missing Persons Section—New in 2010!

The Federal Bureau of Investigation established a cooperative agreement with the Minnesota Bureau of Criminal Apprehension to provide funding and support for STR analysis on evidentiary items from missing persons and unidentified human remains. This agreement will prove beneficial to law enforcement in the identification of missing persons.

Funding from the FBI will provide nuclear DNA testing for national missing persons and unidentified human remains cases for upload to CODIS.

The Minnesota Bureau of Criminal Apprehension is the *only lab* in the country to secure this funding! The newly created Missing Persons Laboratory Section will work closely with the Mitochondrial DNA group. Funding will allow for the hiring of 4 new DNA analyst positions.

Family members can voluntarily submit DNA samples for profiling and upload to the National Missing Persons DNA Database. Samples from unidentified human remains (among other pertinent and probative evidence) are profiled and also entered into this database. These samples are compared to each other to identify any potential matches. Nuclear DNA and mitochondrial DNA profiles are currently uploaded to the database, with Y-STRs to soon follow.

Pedigrees are also constructed to show relationships among family members and their missing loved ones. Pedigrees also allow for what is called metadata—information that may aid in an identification of the missing person such as scars, tattoos, and other physical anomalies. Pedigrees can also be searched against unidentified human remains.

The BCA is the only lab in the country to secure FBI funding for a Missing Persons Laboratory

Nuclear DNA Section

2009 was a productive year for the Nuclear DNA Section as we issued 3,147 reports. Overall we had a 72 day turn around time for DNA cases.

It was an active year for our cold cases as well. Four "new" cold cases were submitted to the lab in 2009. More than 20 others are still in progress, either in serology or DNA. We have a number of scientists who continue to work diligently on these challenging cases. From the cold cases worked on in 2009, 3 cases yielded unidentified Y profiles and 10 cases yielded unidentified nuclear profiles. There were three hits on the convicted offender databases in three unsolved homicides. In another homicide, scientists were able to develop a profile from the scene matching the suspect. Two cold cases were resolved this year due to the hard work of the DNA section. In one homicide, a suspect pled guilty due to the DNA results. In a second homicide, the suspect went to trial and was found guilty. A cooperative agreement between the BCA and Minneapolis in 2007 brought on two additional scientists. These scientists have been performing serology and DNA testing on Minneapolis cases. Minneapolis has provided for the funding of two additional scientists to work on Minneapolis cases, bringing the total to four. Recently, three more Nuclear DNA scientists joined our section. They will train first in serology, and then later in the year, in DNA. We continued to use the Tecan EVO robot for known samples. This automation has allowed us to ensure separation of samples as well as speed up the testing process.

Promega Maxwell Robotic System

New Genetic Analyzer at the Lab

This year, we went online with our newest genetic analyzer which has the ability to process four samples in the time it took to previously process one! We are excited to have this instrument online and have a second one undergoing the validation process with plans of having it up and running by early spring. We are currently training in the use of a small robotic system for processing samples. Using this system, a step of the testing process that previously took three hours has now been reduced to one. With these new technological advancements we hope to improve upon on turnaround time while maintaining a high quality product.

ABI 3130 Genetic Analyzer

*The BCA Laboratory was able to assist in **335** criminal investigations using CODIS.*

Offender DNA Database Section

In 2009, the BCA Laboratory was able to assist 335 criminal investigations using information obtained from the Combined DNA Index System (CODIS). Over 45% of these were burglary investigations, 15% were theft, and 12% were criminal sexual conduct cases. Throughout the past year, the Offender DNA Database Section has consistently been able to upload convicted offender DNA profiles to the National DNA Index System (NDIS) within 30 days of the date of receipt. 2009

marked the BCA Laboratory's validation of an automated procedure for extraction of DNA from convicted offender and casework reference samples using the Tecan Freedom EVO Robotic Workstation. This automated method has helped to streamline the processing of criminal cases as Offender group scientists can now profile the reference samples, allowing Nuclear DNA/ Casework group scientists to focus on questioned evidence items. Each scientist has also completed training in serological and/ or casework DNA analysis, enabling them to provide assistance to the Nuclear DNA/Casework group in those areas, as well.

Drug Chemistry

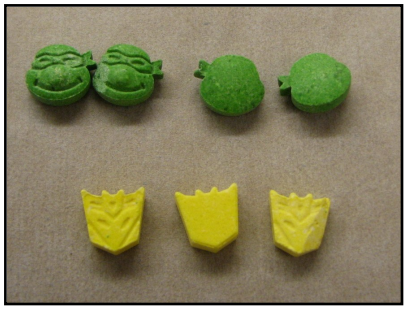
In 2009, the Saint Paul Drug Chemistry section experienced various personnel adjustments. The lead scientist took over some supervisor responsibilities. In June, the section began providing assistance to the Toxicology section by offering two scientists to help part-time with their rapid influx of cases after the Intoxilyzer Ruling. This assistance will carry through the first quarter of 2010. In September, the lab welcomed back one of their experienced scientists returning from a five year military leave. Another scientist continues to share time with the Chemical Testing Section. With all that said, the Saint Paul Drug Chemistry section has six full time scientists and four scientists sharing time with other areas of the laboratory.

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 2,032 cases in 2009 and reported1,983 cases. Methamphetamine continued to be the most prominent controlled substance reported at the Saint Paul Drug Chemistry Lab. Of the 3,224 reported items, 1,145 items were reported as containing methamphetamine. Cocaine was the second most reported controlled substance with728 items containing cocaine. Marijuana continues to make up a small fraction of the items analyzed due to the section's policy on only analyzing suspected marijuana with a court date.

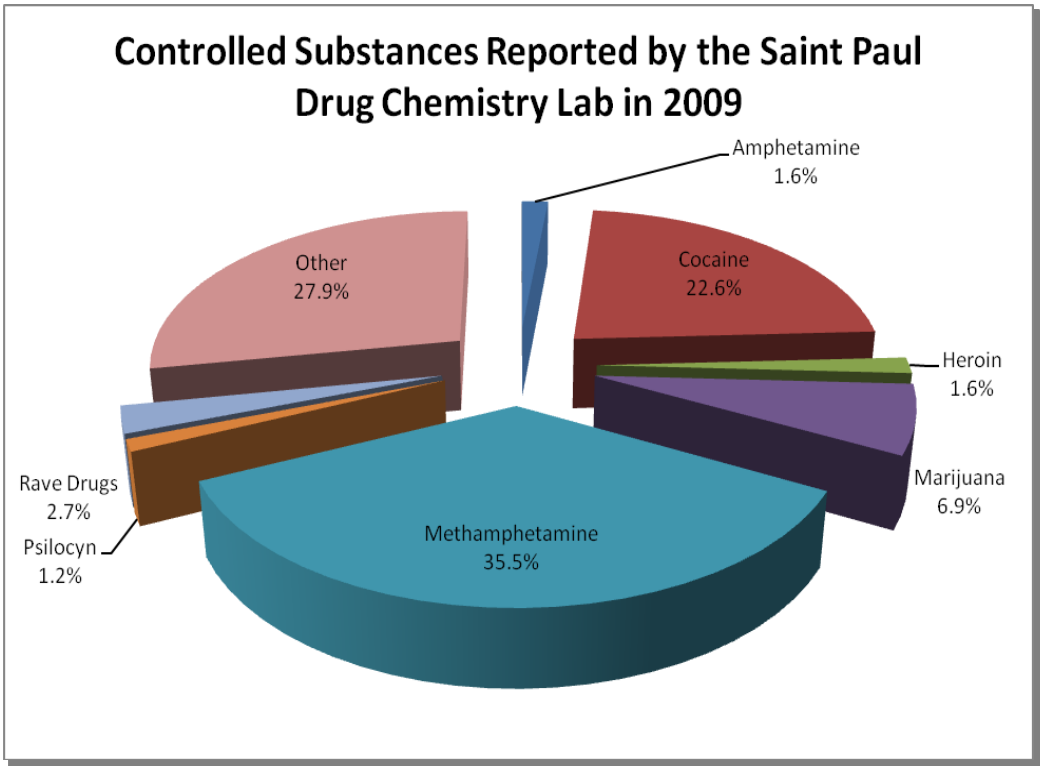
"The Saint Paul Drug Chemistry Section received 2.032 cases in 2009 and reported 1,983 cases."

Increased Amounts of Ecstasy

In addition to the methamphetamine and cocaine submissions, the Drug Chemistry section noted an increased trend in Ecstasy mimic tablet submissions containing benzylpiperazine (BZP). BZP is a federally controlled substance in the United States (Schedule I). This drug is a potent central nervous system stimulant that produces amphetamine-like effects and is also described to be mildly hallucinogenic. BZP submissions have included figure shaped tablets such as Teenage Mutant Ninja Turtles, Decepticons and Autobots from Transformers, Simpson characters, and Smurfs *(some pictured top right)*. These tablets have such detail that one would think they were looking at children's vitamins. Other submissions have included brightly colored round tablets with various welcoming logos and top shaped tablets *(pictured bottom right.)*



Examples of Ecstasy Tablets



The Drug Chemistry Section's primary goal is a 30 day turnaround time

Looking Ahead to 2010

The section's primary goal for 2010 will be a thirty day turnaround time for drug cases at both the Saint Paul and Bemidji Lab locations. To help achieve this goal, select members of the section and management took part in a process mapping application. Under the direction of the Midwest Forensics Resource Center (MFRC), the team mapped out the entire process a drug case goes through from the moment of intake to the time it leaves the lab. The mapping team identified possible areas for improvement. Members ended the year in a solution identification stage and were evaluating the impact these solutions will have on the overall efficiency of the process. Solutions with the greatest potential for efficiency improvement will begin to be implemented and results evaluated throughout 2010. This process mapping could not have come at a better time. The Minneapolis Department of Health and Family Support Laboratory closed its doors at the end of the year. As a result, the section has started receiving cases from the Minneapolis Police Department and other surrounding agencies within Hennepin County. The section understands the significance of timely results for the investigation and prosecution of controlled substances. We are optimistic a thirty day turnaround time will be achieved.

Trace Section

Over the last decade, the forensic discipline of Trace evidence analysis has undergone significant changes in response to the needs of the criminal justice community. At the BCA, the Trace area was also greatly impacted by retirements, promotions, and transfers. Moving to a spacious world class forensic facility in 2003 allowed the Trace area to grow slow and steady - incorporating a variety of faster modern instrumentation, attracting experienced personnel to fill vacant/ new positions, and providing much needed resources for in house training and continuing education.

The Trace area is very fortunate to have energetic motivated scientists who work effectively as a team. Within Trace, there are two scientists who focus on hair cases as a part of the FBI Regional Mitochondrial DNA program. The rest of the Trace crew consist of two full time scientists, one scientist who splits her time between Trace and Chemical Testing, and one scientist who has come out of retirement to help with backlog casework and training.

Five Trace Scientists are certified by the American Board of Criminalistics

Professional Involvement

Professional involvement by BCA Trace scientists continues to be one of the greatest resources that helps shape our section and provides access to continuing education. Our supervisor is serving her second term as Newsletter Editor for the Midwestern Association of Forensic Scientists (MAFS). She also serves on the Tape Committee of the Scientific Working Group on Materials Analysis (SWGMAT). Five Trace scientists (including our supervisor) are certified by the American Board of Criminalistics (ABC) which requires passing a competency exam in a discipline and yearly continuing education credits. The majority of the Trace scientists belong to MAFS, the American Academy of Forensic Sciences (AAFS), and the newly formed American Society of Trace Evidence Examiners (ASTEE). Several of the scientists are teaching semester and/or short courses at Metropolitan State University and the University of Minnesota. One of the Trace scientists serves on the forensic science committee of the American Society of Testing and Materials (ASTM) and is a member of the Technical Working Group for Fire and Explosives (TWGFEX). Three of the Trace scientists also participate on Crime Scene Response Teams.

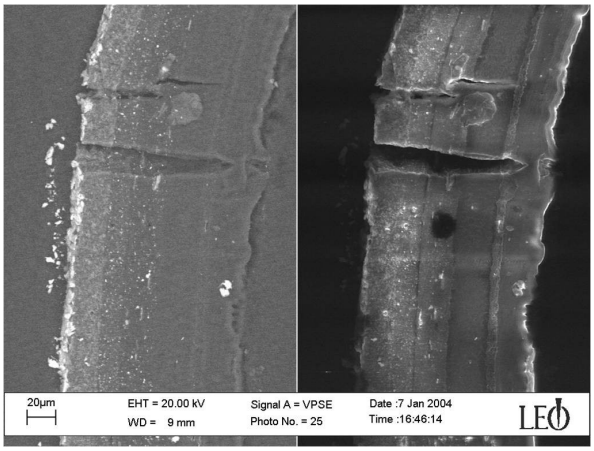
Evidence in Trace

In 2009, the Trace section received 261 cases and issued reports on 250 cases – 19 of these cases were from the FBI Mitochondrial Trace scientists. This is a 150 % increase in both section work load and case production when compared to previous years! Most of our cases involved classifying and comparing paint, plastics, fibers, fabric damage, glass, human hair, wood, soil, tape, metals, shoeprints, and tire tracks. This achievement can be attributed to many factors. The addition of two experienced scientists has dramatically reduced the amount of time required for additional training. Another scientist has completed all of the basic training (14 different units) needed to conduct any type of Trace exam. The remaining scientists divide their time between casework and training in another Trace discipline. Every few months, a scientist completes a training module and is able to expand the types of cases they can work. Finally, our 2009 ISO International accreditation means we completely overhauled our methods, forms, and standard operating procedures to help streamline how we store, examine, and report out on trace evidence.

There was a 150% increase in case production in the Trace Section in 2009!

What kinds of exams are conducted on Trace Evidence?

With forensics being portrayed in many forms of media (fiction and non-fiction), it is vital to keep an open dialogue with law enforcement about what kinds of examinations are performed in Trace. The most basic exam we perform is to classify what an object might be, especially when the evidence is not easily viewed with the naked eye. A microscopic examination of evidence can provide investigative leads for an active case. For example, in a hit and run case, classifying evidence as automotive paint prompts an investigator to find a possible known source of paint (suspect vehicle). Once a sample of the known source of paint (suspect vehicle) is submitted, a comparison between the unknown paint and the known paint may provide a link between a suspect vehicle and a victim.



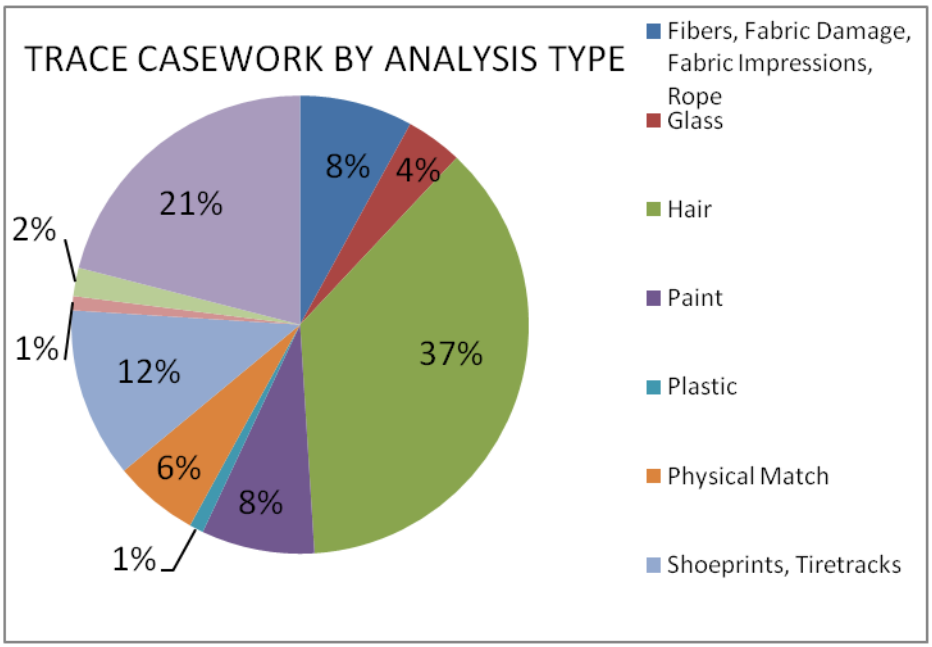
7 layered paint chip (viewed under the Scanning Electron Microscope) using two different detectors simultaneously allowing the scientist to differentiate all 7 layers

Comparative examinations are by far the bulk of most Trace cases. One of the cornerstones of Trace evidence examination is the concept of cross-transfer. Simply put, cross-transfer can occur whenever two objects come into contact with each other. There may be visible or microscopic exchange between the two objects at the site of impact. Using the hit and run case example stated above, an additional link could be established between unknown fibers found embedded in a fabric impression observed on the suspect vehicle and the clothing of the victim.

Trace-Known vs Unknown

In order for a Trace scientist to investigate whether a linkage exists between a victim and a suspect, it is imperative for our clients to collect probative known and unknown evidence samples. For instance, in the same hit and run example used earlier, it may be necessary to collect known paint from several areas of the car – the paint chemistry of the bumper may be different from the paint chemistry of the quarter panel or even the hood. It may also be necessary to collect all of the clothing of the victim to determine if the fibers found on the bumper originated from the victim's shirt, jacket, or slacks. What if microscopic glass pieces were found in the clothing? It would be helpful for the investigator to collect known glass directly from the frame of any broken windshield and/or broken side windows, mirrors, and headlights. In contrast, collecting glass from the street near the broken car window would not be an appropriate known- technically it is considered an unknown. Because of the variety of evidence we see, we have developed a two page Collection and Packaging Guide specifically for Trace evidence. Please contact us to get a copy. Finally if you have any questions about appropriate known and unknown evidence collection, do not hesitate to give us a call even when you are on the scene!

37% of the case work in the Trace Section in 2009 was Hair Analysis



Tips for Packaging

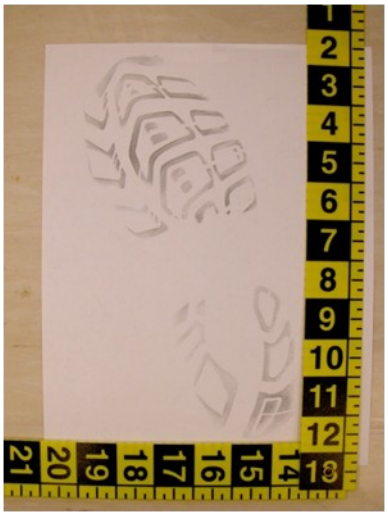
Most of the evidence we encounter in the Trace area by its very nature is small, delicate, and very easy to lose. As Trace evidence examiners, we do our best to be minimally invasive as we conduct our analysis, in order to preserve the evidence for court or defense testing.

The packaging of trace evidence can be tricky. Here are some suggestions.

- "Post-It" notes are excellent for securing trace items of evidence. Fold the "Post-It" and place inside a small labeled envelope. Tape all seams of the envelope.
- Submit each item in a separate envelope/paper bag that is size appropriate for the type of evidence. Remember that multiple people may be opening and re-sealing the envelope/ paper bag. However, please don't put a fiber in a grocery bag.
- Evidence that has been exposed to moist environments especially biological fluids need to be air dried before packaging in an envelope / paper bag. The envelope /paper bag needs to be taped along the seam so that a fragment of hair, fiber, glass, soil, paint, etc. cannot 'slip through the cracks'.
- Plastic bags for clothing are to be avoided because plastic does not 'breathe' which in turn fosters mold and bacterial growth destroying the integrity of our analysis.

"Plastic does not 'breathe' which in turn fosters mold…"

For tire tracks and shoeprints, there are additional guidelines suggested. If at all possible, please submit the actual tire track or shoeprint, any casts, and suspect shoes/ vehicle. Good photographs need to be taken using oblique lighting and must include a ruler for scale. Whenever possible, take photos from a perpendicular position (90 degree angle) using a level. Please refer to the examples below. Note that the 'Poor technique' example cannot be used for a comparison due to the distortion. A CD with digital images including dates and times can be submitted as an additional item of evidence. In the laboratory, the Trace scientist will use the ruler in the photograph to enlarge the print to life-size and use it for comparison with a known (suspect) print.

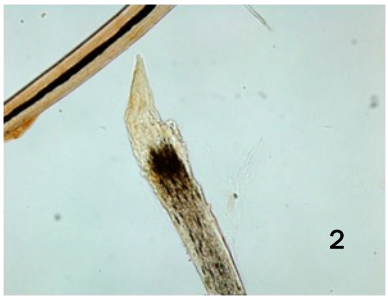


Good Photo

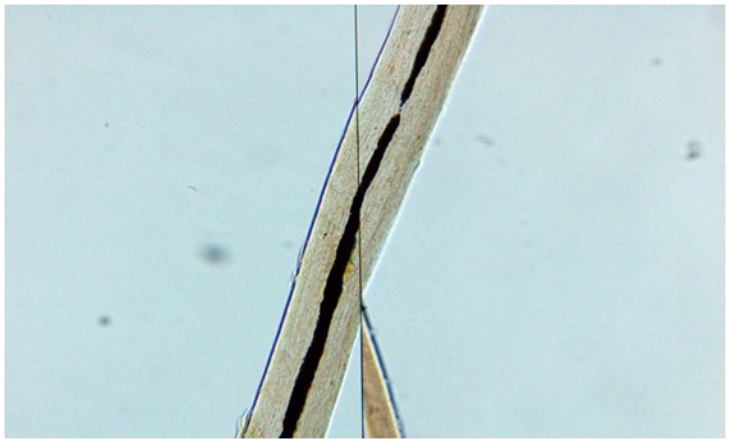
Poor Photo

Hair Exams

If a nuclear DNA profile can be gleaned from a human hair root, spectacular results are possible giving “one in the world” statistics. Most human hairs submitted as evidence are naturally shed and are not conducive to nuclear DNA extraction. The Trace area assists the Biology Section by screening hairs and determining their suitability for nuclear DNA testing which saves a considerable amount of time and resources. A microscope is used to examine the root end of the hairs, in order to determine if they are suitable. The hairs in photos 1 and 2 are “suitable” for nuclear DNA analysis and the hair in photo 3 is “not suitable”. Microscopes are also used to examine hairs in order to determine if they are animal or human. If human, body area and racial characteristics can be determined. If a questioned hair is found to be human and is either a head or pubic hair, it can be microscopically compared to a known hair sample and determined if it could have come from the same source as the known hairs. The microscopic characteristics of a questioned hair and the known hair sample are compared, side by side, using a comparison microscope.



The root end of the hair is examined to determine if it is suitable for DNA testing.



Hair Comparison Using a Comparison Microscope

The Trace Evidence Section: Chemical Testing

The Chemical Testing Unit covers two sub-disciplines: Fire Debris Analysis and the Analysis of Chemical Unknowns. Fire Debris Analysis involves the analysis of materials from a fire to determine the presence of and identification of an ignitable liquid. This is essentially a three step process: extraction of volatile compounds from the submitted material, separation and detection of those volatile compounds, and data analysis to identify those compounds and their possible source.

The Chemical Testing Unit covers two sub-disciplines: Fire Debris Analysis and the Analysis of Chemical Unknowns

Evidence

While most materials to be tested for ignitable liquids consist of debris from a fire, other items that can be tested include clothing from a victim or suspect, suspected liquids, soil or vegetation from around building exteriors, or empty containers suspected of carrying an ignitable liquid to the scene.

Three examples of evidence: soil, charred newspaper, burned carpeting

Collection

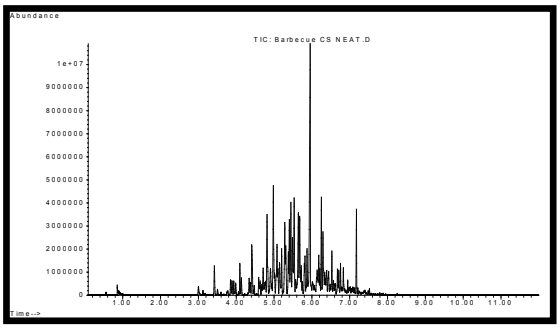
When collecting solid samples, try to obtain samples that are only partially burned, keeping in mind that absorbent materials, such as carpeting, are better than non-absorbent materials, such as metals. Whenever possible, collect separate samples of the same material from an area that has been protected from the fire (comparison sample). Always use an airtight package, such as a lined metal paint can with a tight fitting lid. Never fill the container more than half full, as the lab uses the space above the debris to perform its analysis. Soil and vegetation samples *must* be kept frozen from the time of collection to the time of analysis to prevent bacterial degradation of any organic liquids that may be present. Nylon or Kapak bags are also acceptable as evidence containers, but an empty bag should also be submitted to the lab as a control. Never use regular plastic bags or containers for fire debris, as the ignitable liquid residues can be lost. Liquid samples may also be submitted for analysis. Samples should be sealed in glass vials with Teflon lined screw caps and secured against breakage during transport. One ounce is more than enough for analysis. The lab can provide packaging for liquid samples for agencies to take with them as needed.

Never fill the container more than half full!

An example of a glass vial for liquid samples, the plastic bottle used to protect the vial, and packaging in an air-tight can for transport

How long does it take to process a typical Fire Debris sample?

- Sample preparation/ Extraction: 18 hours, done overnight
- Sample Analysis: 40 minutes per sample, plus quality assurance runs
- Data Analysis: 1 to 5 days, depending upon complexity of sample and background materials
- Case Review: 1 day



Chemical Unknowns

The Analysis of Chemical Unknowns involves the examination of materials for identification of non-narcotic substances. This type of evidence can be encountered at a variety of crime scenes, from burglary to homicide, from vandalism to sexual assault. Evidence can be of any type – solids, liquids, mixtures, even gasses. Submissions may be for identification and/or comparison to a known sample. Several cases submitted in the last year have involved attempted poisoning, using household products such as drain cleaner to adulterate a food or beverage. Other cases the lab has seen this year include chemical reaction bombs (whereby common household chemicals are mixed together to produce a gas, which explodes the container, usually a pop bottle), unknown white powders (all white powders submitted to the lab for identification must be cleared for active biologicals first), and food that was suspected to be contaminated with pepper spray.

An example of a chemical reaction bomb. While intended as harmless pranks, the chemicals used in these devices can cause serious burns, while the pressure from the gas can be sufficient to cause property damage and bodily harm

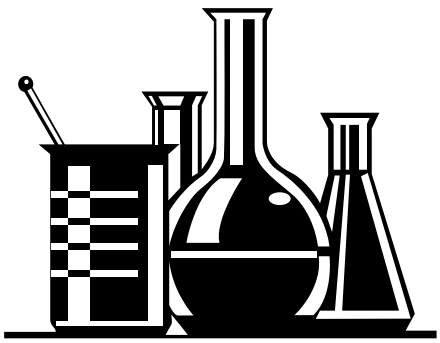
Chemical Unknown cases vary in their completion time

Left: An unknown white powder and liquid in an unmarked bottle. This bottle was taken from a protester at a demonstration. The substance was identified as antacid suspended in water – a recipe circu-

Right: An example of a powerful pepper spray used in an assault and robbery, which eventually lead to a shooting. The chemical components of this spray were found both at the scene and on one of the suspect's clothes

How long does it take to process a Chemical Unknown case?

The honest answer – it depends! Some chemical unknown cases are straightforward, and may only take a day or two to analyze. Others are more complicated, or require extensive sample preparation and/or multiple analyses. Some cases may even require some research before proceeding with examinations. These cases may take a week or more for full results.



Additional Analysis in Chemical Testing

The Chemical Testing Unit also performs analyses for acids and bases (corrosives and caustics), bleach, tear gas, security pack dyes (such as from the exploding dye packs used to deter bank robberies), fire extinguisher residues, sugars from gasoline tanks, and various organic liquids.

Evidence: Materials submitted for chemical identification can be solids, liquids, gas tanks, clothing with stains or holes, mixtures, swabs, etc...

Stained Money from Exploding Dye Pack

Collection: The nature of the evidence will dictate the packaging. Here are some guidelines for some commonly encountered materials:

"The nature of the evidence will dictate the packaging."

Acids & Bases (corrosives and caustics, including Bleach), Chemical Reaction Bombs:

Liquids & Solids - Package in regular plastic. Do NOT use arson bags or paper.

Clothing, etc. – If DNA is more important, place DRIED item in paper. If chemical identification is more important, place item in plastic while still wet and store in refrigerator. If both are needed, place in plastic and notify Chemical Testing so it can be analyzed and repackaged ASAP.

Exception – suspected ammonia, acetic acid (vinegar), or alcohols – place items in a tightly sealed can.

Pepper Spray, Mace, Tear gas, Bank dyes, ATM dyes

Canisters, Security packs – Package in regular plastic or security envelope, unless DNA needed. Paper bags OK, but clearly label suspected contents.

Clothing, Carry bags, etc. – Paper bags OK.

Organic Liquids

Examples: rubbing alcohol, acetone, chloroform, dry cleaning solvents, etc.

Bottles –Package sample of liquid in 1 ounce glass vial with outer arson bottle or can.

Clothing - If DNA is more important, place DRIED item in paper. If chemical identification is more important, place in a tightly sealed can while still wet and store in refrigerator. If both are needed, place in can and notify Chemical Testing so it can be analyzed and repackaged ASAP.

Criminalistics

Firearms

The Firearms Section provides a variety of examinations, including tool mark identification, bullet and cartridge comparisons and function testing and firing of a multitude of firearms. Cartridge cases are searched against a database maintained in the National Integrated Ballistics Identification Network (NIBIN). Distance determination and ejection pattern analysis are two additional exams offered. The section added a trainee to their staff who transferred from another BCA laboratory discipline. She came on board with 10 years of forensic experience and within two months was assisting the section with their backlog of NIBIN cases. Her training continues at the BATFE National Firearms Training Academy in Maryland which requires a four month commitment. The section now has three examiners and one NIBIN technician. During 2009, the section reduced their backlog by about 100 cases. This included entering nearly 500 items into NIBIN which yielded a total of 34 "hits." These hits provided invaluable information to local law enforcement investigators.

34 "Hits" were made in 2009 in NIBIN at the BCA

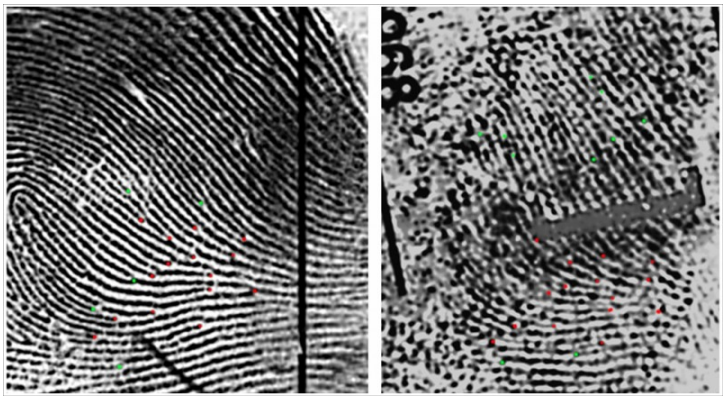
Forensic Scientist Using NIBIN

Latent Prints

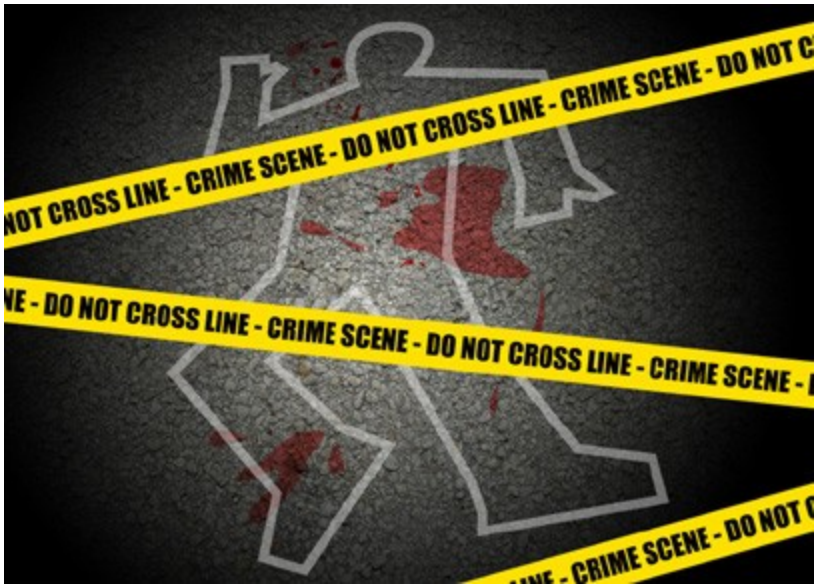
The Latent Print section processes a myriad of items in an attempt to develop latent prints of value. Comparisons are made to known fingerprints and unidentified latent prints are searched against a multi-state database of known fingerprints using an Automated Fingerprint Identification System (AFIS). This database is known as the Midwest Automated Identification Network (MAFIN) and is comprised of Minnesota, North and South Dakota. There are five Certified Latent Print Examiners and one trainee. In addition, there is a latent print processing technician. The trainee has been attending an aggressive training program offered by the National Forensic Science Training Center (NFSTC). The course is eight months in duration, combining classroom sessions and home laboratory assignments. During 2009, the section reported on over 1,000 cases. There were 150 hits in the AFIS, identifying new suspects. Included in that total were 29 "reverse" hits. When a latent print fails to hit after being entered into the AFIS, it may be placed in the system's Unsolved Latent File. The prints in the ULF are compared against all new fingerprint cards added daily to the database. These hits are typically against cases that are several years old with no suspect being identified. Since the AFIS was upgraded, palm prints are now being captured during the booking process. As a result, one of the first reverse hits of 2009 was a palm print associated with a year old robbery case. After the suspect was developed, seven additional latent prints in the case were identified. Three other reverse hits cleared a pair of two year old burglary cases and another theft case identified two suspects from North Dakota. During the late summer and early fall of 2009, the section collected data for a latent print research study, under the direction of the lead technical worker, Glenn Langenburg, and the Forensic Science Services of the United Kingdom. Glenn took a corresponding leave of absence to oversee the project and pursue his doctoral degree. The results of this study will be published in 2010. Glenn has continued to represent the BCA and the latent print discipline in nationwide technical working groups as well as National Institute for Justice (NIJ) and NFSTC programs. Much work is being done in the field in response to the National Academy of Sciences report which was published in early 2009.

Two examiners had articles published in the Journal of Forensic Identification, a publication of the International Association for Identification. Based on a research project, Josh Bergeron authored, "Use of Liquid Nitrogen to Separate Adhesive Tapes" describing a process that was subsequently placed into practical use at the BCA laboratory. Glenn Langenburg wrote an article discussing the ACE-V process addressing issues such as accuracy and bias. Both Josh and Glenn are also involved in teaching private classes to latent print examiners for which they have received nationwide recognition. Their work has been of great benefit to the BCA Laboratory and the latent print discipline.

Over 1,000 cases were reported by the Latent Prints Section in 2009



Latent Print Comparison



The Crime Scene Response Team attended 40 scenes in 2009

Crime Scene Response Team

Crime Scene Response
The St. Paul Crime Scene Team consists of 15 forensic scientists from various disciplines in the laboratory. A team of three scientists is on call 24 hours a day responding to homicides and other death scenes where there might be a question as to what happened.
The section attended 40 scenes and processed an additional 10 vehicles in the garage bays at the BCA laboratory. The responses included separate requests for specialty examinations which are comprised of bloodstain pattern interpretation and/or shooting reconstruction. Almost a quarter of the responses in 2009 involved officer involved shooting scenes. In one case, an officer lost his life while responding to a domestic situation. Another officer shot and killed the suspect. For the responding team, this was the most difficult scene they had encountered in their careers. While struggling with various emotions, they remained on task and were able to complete their work in a professional manner resulting in a detailed accounting of the scene. All crime scene analysts are to be commended for their diligence in identifying, collecting and documenting physical evidence; always under less than favorable conditions and in all kinds of weather.

Forensic Documents

The Forensic Document Section continues to offer a multitude of examinations including handwriting comparisons, printer and copier comparisons/ examinations, ink and toner examinations, and the occasional typewriter examination. The primary evidence received is comprised of paper documents with requests to analyze the handwriting.

The section is staffed by a team of two forensic scientists. The lead technical worker is certified by and is a Diplomate of the American Board of Forensic Document Examiners (ABFDE) and also serves as Section Chair for the Forensic Document division of the Midwestern Association of Forensic Scientists (MAFS). Both examiners are members of MAFS and one is a probationary member of the American Society of Questioned Document Examiners (ASQDE). The section also serves on the forensic science committee of the American Society of Testing and Materials (ASTM).

In 2009, the Document section reported on 66 cases. One involved a large number of letters and envelopes that contained aggressive and threatening messages. Such threat cases have become common, a sharp deviation from the check fraud, identity theft and money laundering that have been seen in previous years.

Both examiners in Forensic Documents are members of MAFS

Tips on Packaging and Collection

The following are tips for submitting evidence to the Forensic Document Section
Questioned vs. Known
In order for a Forensic Document scientist to investigate whether a linkage exists between a victim and a suspect, it is imperative for our clients to collect the correct known and unknown evidence samples. For instance; if a questioned document bears **upper and lower case printing**, comparable words, letter combinations and/or numbers should be collected from a suspect by asking him/her to write in **upper and lower case printing**. Due to the variety of evidence a one page Collection and Packaging Guide was developed specifically for Forensic Document evidence. It is the first page of the BCA Guidelines for Obtaining Known Handwriting Samples Packet. Contact the Document section to obtain a copy or visit the BCA Laboratory website.

Packaging
When evidence arrives at the BCA, it is inspected and cataloged. Depending upon the type of exam requested, the item may pass through many different hands and locations creating a chain of custody that is tracked. The Forensic Document evidence examiners attempt to be minimally invasive while conducting the analysis, to preserve the evidence for additional forensic examinations as well as court and/or defense testing.
Here are some suggestions for the packaging of Forensic Document evidence.

- "Post-It" notes are excellent for securing small items of evidence (staples, loose stamps, etc.). Fold the "Post-It" and place inside a small labeled envelope. Tape all seams of the envelope.
- Label all container/envelopes **before** placing the evidence in the container/envelope.
- Submit each item in a separate envelope/paper bag that is size appropriate.
- Evidence that has been exposed to moist environments, especially biological fluid, needs to be air dried before packaging in an envelope /paper bag. The envelope /paper bag needs to be taped along the seams so that trace evidence cannot fall out of the packaging. The package/envelope needs to be marked as possibly containing biological or hazardous material.
- Avoid the use of plastic bags as they do not 'breathe' which may foster mold and bacterial growth, greatly hindering an analysis.
- Place paper documents that may need indented writing impression examinations between two pieces of cardboard prior to placing in an envelope, box or paper bag. Tape all seams of the outer container.
- When questioned writing appears on surfaces that cannot be brought into the lab, photographs need to be taken using oblique lighting and should include a ruler for scale. Whenever possible, take photos from a perpendicular position (90 degree angle). CDs containing digital images including dates and times can be submitted as evidence.

Post-it notes are excellent for securing small items of evidence

Toxicology

2009 was a tough year for keeping up with the caseload. We saw nearly 13,000 cases submitted for alcohol and 10% of those normally go on for toxicology work (1,300). Because case submissions have been relatively static for the previous four years 2004-2007, we believe the majority of this increase is due to reduced use of the Intoxilyzer. This nearly 30% increase in caseload required a reallocation of resources. With help from other section staff we were able to get most alcohol reports out within five weeks but the toxicology turn around really suffered. Currently, many agencies have returned to using the breath testing instruments and blood and urine case submission has leveled off. We have been able to eradicate the backlog, returning to a two week turn around for alcohol reports and we are making strides in the toxicology area as well. During this time, we successfully evaluated, re-wrote and updated all section policies and procedures allowing us to achieve ASCLD/LAB-International accreditation. All section staff worked tirelessly towards this goal.

We welcomed a new forensic scientist to our staff bringing our number of benchworking scientists to 10. This has helped greatly as we continue to try to keep up with the caseload.

Our goal by Summer 2010 is to have new instrumentation on line that will provide better screening techniques and faster confirmations. We continue to test for the usual drugs of abuse but our intent is to expand our capabilities, identifying more drugs as well as producing reports in a timely manner for court.

We have seen a great increase in huffing/Dust Off cases this last year. 1, 1 difluoroethane, present in aerosol computer cleaners seems to be the convenient way to get high. Inhalation of this substance can cause black outs, not a good thing to do while driving.

We continue to have heavy courtloads with various issues presented. Staff is required to travel the entire state which is very challenging when trying to complete lab work. Our hope is that ITV testimony is more utilized allowing for meaningful testimony without the commute and wait time.

There was a 30% increase in caseload in Toxicology in 2009

Samples for Toxicology Testing

Breath Testing

In October of this year we received notice that we will be receiving federal funding to replace our aging fleet of instruments. The instruments currently in the field have been in use since 1997. As they age, they require more frequent and time consuming maintenance. In addition, parts have become increasingly difficult to acquire. With the advancements that have been made over the past ten years, we hope to implement a new fleet with improved data collection capabilities that will allow for real time data collection and graphed breath profiles.

Demands for Intoxilyzer source code continue to be a tremendous issue for the Breath Test Section. In January alone, we had a record high 50 court appearances assigned to the two scientists. While the burden lessened slightly, this court trend continued until the release of the Federal Lawsuit Settlement on July 16. This settlement allowed for defense attorneys to have direct access to the source code, either in written format within the state of Minnesota, or in the electronic format at the instrument manufacturer headquarters in Owensboro, Kentucky. With this settlement, Intoxilyzer use increased as a means to determine a person's alcohol concentration after a DWI arrest, but most court cases have been put on hold while the defense bar organized a source code review team. To date, source code has still not been reviewed and court cases are still on hold. A hearing combining over 700 Implied Consent cases and numerous DWI hearings is expected to occur in the summer of 2010.

The instruments currently in the field have been in use since 1997

Intoxilyzer 5000

Bemidji Laboratory

In December of 2009, the Bemidji Laboratory had the distinction of becoming the 100th forensic science laboratory to become accredited under the ASCLD-LAB International Accreditation program. The St. Paul lab, of course, was the 99th. Although the two laboratories are part the same agency and share quality and management systems, each lab must undergo separate assessments to ensure that the standards are being met at both locations. Previously, both labs were accredited under the ASCLD-LAB Legacy program. The ASCLD-LAB International program differs from the ASCLD-LAB Legacy program in that it is based on ISO 17025 standards and supplemented by standards specific to forensic laboratories.

The Bemidji Laboratory reached somewhat of a milestone during the year. Since the facility opened for business in October of 2001, at least one of its scientists was in training status. The reasons for this were due to personnel changes and/or additions, as well as the amount of time it takes to complete the training program, one to two years, depending on the forensic discipline. By the end of 2009, all the scientific staff in the Bemidji Laboratory were signed off to perform casework in their specific disciplines.

With 100% of the scientific staff performing casework, the Lab also worked to increase its capacity and/or efficiency by adding or replacing equipment. The Drug Chemistry section added a new gas chromatograph/mass spectrometer (GC/MS) bring the total number of such instruments to three. The DNA section purchased three new instruments during the year. One of these was a Sperm-Hi-lyter system that will aid in the scientist in the search for spermatozoa with certain types of samples. A Maxwell 16 robot, designed to extract DNA from 16 samples in about an hour, was also purchased. Finally, an ABI 3130 genetic analyzer, which has the capacity to analyze four DNA samples at a time as opposed to the single sample ABI 310 that is currently in use, was purchased through a trade-in agreement. Validation studies of all three new instruments are scheduled to be completed in early 2010.

By the end of 2009, all the scientific staff in Bemidji were signed off to perform casework