



DNA Laboratory Efficiency Program: Fiscal Year 2009 Awards and Abstracts

This document lists grants awarded by NIJ in 2009 under the DNA Laboratory Efficiency Program. The abstracts are reproduced here exactly as they were submitted by the grantee.

FY09 DNA Unit Efficiency Abstracts

This table is a summary of DNA Unit Efficiency Awards issued in FY2009. Following this table are their respective abstracts.

FY09 Recipient Name	Award Number	Award Amount
City of Los Angeles	2009-DN-BX-K034	\$246,549
County of Orange	2009-DN-BX-K033	\$1,499,930
Palm Beach County Sheriff's Office	2009-DN-BX-K261	\$519,544
Massachusetts State Police	2009-DN-BX-K259	\$278,584**
Oklahoma State Bureau of Investigation	2009-DN-BX-K160	\$23,783
University of North Texas Health Science Center At Fort Worth	2009-DN-BX-K171	\$265,393
Wyoming Office of the Attorney General	2009-DN-BX-K249	\$412,297
TOTAL FUNDING		\$3,246,080

FY09 Recipient Name: City of Los Angeles

Award Number: 2009-DN-BX-K034

Award Amount: \$246,549

Abstract: Over the last 12 years, the Los Angeles Police Department (LAPD) has accumulated approximately 6,132 sexual assault evidence kits (SAKs) which had not been previously examined. Historically, roughly half of all collected SAKs were ever examined. The lack of appreciation for the ability of these unexamined kits to provide investigative information and the resultant lack of resources led to its accumulating, untested, in the Department's evidence freezers. The City of Los Angeles has recently devoted significant resources to examining, where needed, all of these kits over the next two years, and putting in place the personnel and infrastructure to allow all SAKs collected in the future to be routinely tested. This also includes the outsourcing of these kits to four different laboratories for screening and DNA profiling. While outsourcing is an efficient short-term solution to the problem, it creates an issue that cannot be effectively addressed by existing LAPD personnel. In order to gain useful investigative information, the DNA profiles generated must be uploaded into the State and National CODIS DNA database. For this to occur, the profiles must be extensively reviewed by a qualified public agency laboratory DNA analyst. Approximately 60% of the kits sent for testing result in a possible suspect DNA profile. That means approximately 3,679 (6,132 x .60) DNA profiles will have to be reviewed prior to being uploaded to CODIS. At approximately two hours per case, that translates to 5,519 (3,679 x 1.5) hours in order to review all of these profiles, or the equivalent of one criminalist working full time for two and one-half (2.5) years, or three (3) criminalists working full time for almost one year each. The LAPD currently employs 16 qualified DNA analysts. Further, any delay in uploading these profiles has the potential to unnecessarily endanger public safety (by allowing a suspect who would otherwise have been identified to continue to offend).

The goal of this proposal is for LAPD to eliminate the SAK backlog while simultaneously implementing the efficiencies which will allow it to deal with all future incoming SAKs. In order to deal with this issue, although the Scientific Investigation Division, LAPD, will perform some of the data reviews, we also propose to utilize the stated cooperation of other public agency forensic DNA laboratories to review additional profiles and upload them into the CODIS DNA

database. This will help relieve some of the burden on the LAPD DNA analysts, and allow them to better focus on completing the training of the newly hired personnel and implementing the numerous efficiency measures which are in various stages of development. These efficiency measures include the routine robotic extraction of evidence samples, laser micro-dissection of spermatozoa from evidence slides, combining multiple cases into groups of samples for concurrent processing and supplementing microscopic screening of SAKs with a PCR-based process, among others.

In order to deal with a doubling in the numbers of SAKs to be examined in the future, these efficiency measures need to be implemented prior to the end of the outsourcing project. In order for that to occur, the LAPD needs the services of all of its DNA analysts to both evaluate and validate the methods proposed ahead of time, as well as deal with the new cases coming in the door each day. That, in turn, requires funds for overtime for both LAPD and other public agency forensic DNA laboratories.

FY09 Recipient Name: County of Orange

Award Number: 2009-DN-BX-K033

Award Amount: \$1,499,930

Abstract: There is a strong expectation that DNA collection from property crime scenes such as burglaries and vehicle thefts will continue to increase significantly in the next few years. The Orange County Crime Laboratory has seen a 315 percent or 3-fold increase of property crime DNA analysis requests from 2006 to 2009.

To meet this increasing demand for DNA analysis, the Orange County Crime Laboratory has developed a novel two-prong approach to improve the efficiency and capacity of the lab to process property crime DNA samples..... an approach that we believe can be readily adopted by other forensic DNA laboratories in the nation.

The first prong of this innovative approach consists of a unique property crime DNA case submission triage system developed cooperatively by the Orange County Crime Laboratory and the Orange County District Attorney's Office. Together, members from both entities evaluate DNA requests submitted to the lab. While forensic DNA analysts examine property crime DNA analysis requests from a scientific basis, prosecutors evaluate the same requests from a legal perspective. Feedback, through the laboratory's LIMS system, is provided to police agency crime scene and investigative personnel regarding case acceptance status. Overall feedback regarding "best forensic opportunities" and DNA sample prioritization will be provided jointly and regularly to police agency personnel by the Orange County Crime Laboratory and the Orange County District Attorney's Office.

The second advancement to improve DNA lab efficiency and capacity is the creation of a laboratory "Property Crime DNA Program." Under the leadership of a new DNA laboratory director, analysts assigned to the Property Crime DNA Program will be in designated teams devoted exclusively to the processing of property crime DNA samples using a customized scheduling system and a highly automated DNA processing platform.

Each Property Crime DNA team will consist of four (4) full-time analysts. The Property Crime DNA teams will utilize existing equipment and planned instrumentation purchases consisting of one (1) Qiagen Universal BioRobot, one (1) large scale DNA extraction robot, one (1) Corbett CAS 1200 robot, one (1) AB multi-capillary Genetic Analyzer, two (2) laser swab cutters, five (5) Power Protection systems and three (3) EZ-1 Advanced XL robots placed into a property crime DNA analysis platform designed to process hundreds of DNA property crime samples each week. Two (2) half-time analysts not assigned to a designated Property Crime DNA team will assist all teams as necessary.

A key feature of the Orange County Crime Laboratory Property Crime DNA Program will be the ability to scale the size of the program to meet the increasing DNA processing needs of law enforcement agencies. The property crime DNA analysis platform will be able to accommodate up to three four member property crime DNA teams in five (5) day rotational blocks:

DAY 1	DAY 2		DAY 3		DAY 4	DAY 5
	batch A	Batch B	batch A	Batch B		
Evidence Screening 10 cases / analyst	DNA extraction		QC CE run		work with other group to perform lab duties	catch up/RDO
-4 casework samples 1 reference sample	1 casework batches 96 well Extraction robot 0700-1000	1 casework batches 96 well Extraction robot 0700-1000	GMID X 1st calls 0700-1000	2nd calls 0700-1000		
each group produces: 2 casework batches of 76 samples each -2 reference batches are processed using the existing major crimes batches. These samples are worked by the major crimes unit.	qPCR setup (Qiagen Universal) (Qiagen Universal) 1000-1100 1000-1100		data analysis and report writing 1000- 1000-		Finish data analysis and report writing	
	quant (ABI SDS 7500) (ABI SDS 7500) 1100-1230 1100-1230				begin evidence screening for the following weeks batches	
	STR amp setup (Qiagen Universal) (Qiagen Universal) 1230-1300 1230-1300					
begin sample digestion of 2-76 sample casework batches	STR amplification (9700 thermal cyclers) (9700 thermal cyclers) 1300-1600 1300-1600					
	3130 set up (CAS 1200) (CAS 1200) 1600-1630 1600-1630					
	3130 set up 3130 (16 capillary) 3130 (16 capillary) 1700-Wednesday morning 1700-Wednesday morning					
Note-all automated batches are verified (witnessed) by a second qualified analyst						
with 8 full analyst and 2 half time	Group 1- 4 full time staff		begin on Monday			
	Group 2- 4 full time staff		begin on Wednesday			
	2 half time staff		fill in as needed			
can increase scale by:						
with 12 full analyst and 2 half time	Group 1- 4 full time staff		begin on Monday			
	Group 2- 4 full time staff		begin on Tuesday			
	Group 3- 4 full time staff		begin on Wednesday			
	2 half time staff		fill in as needed			
with 16 full analyst and 2 half time	Group 1- 4 full time staff		begin on Monday			
	Group 2- 4 full time staff		begin on Tuesday			
	Group 3- 4 full time staff		begin on Wednesday			
	Group D- 4 full time staff		begin in the afternoon of any day			
	2 half time staff		fill in as needed			
Increased throughput beyond ~160 cases/week could be achieved but would require additional robotic instruments, equipment and analysts						

Table A

Thus, three 4 member Property Crime DNA teams, with the assistance of two (2) half-time analysts will be able to screen, analyze and deliver approximately 560 property crime scene DNA sample results each week.

This unique “ramp up feature” of the Property Crime DNA Program permits maximum flexibility and wise utilization of precious DNA resources. Additional Property Crime DNA teams and instrumentation platforms can be added in a measured approach that balances budgetary concerns and law enforcement DNA processing needs. As well, smaller laboratories or those operating under severe budget constraints could realize significant gains in DNA processing efficiency and the reduction of backlogs using this outlined approach.

FY09 Recipient Name: Palm Beach County Sheriffs Office

Award Number: 2009-DN-BX-K261

Award Amount: \$519,544

Abstract: Palm Beach County has a population of 1.2 Million and in 2006 there were 722.1 violent crimes per 100,000 individuals¹. Currently there are nearly 700 cases backlogged in the Forensic Biology Unit (FBU) of the Palm Beach County Sheriff’s Office (PBSO) Crime Laboratory which serves nearly 30 agencies. The current FBU turn around time averages 6 months for violent crime and 15 months for property crime. In order for the laboratory to accomplish the goal of a 30 day turn-around through efficient testing of all informative evidence for violent crimes and property crimes, the overall turnaround time for the handling, screening, and analysis of forensic DNA samples must be reduced while concurrently reducing the existing DNA forensic casework backlog. Over the past ten years the FBU has used National Institute of Justice (NIJ) Backlog Reduction² grant funding to consistently move in a positive direction to increase the efficiency of the DNA analytical process predominantly through automation of laboratory techniques. Although the efficiency by which the actual DNA process has increased, the backlog of cases has also increased. The nearly thirty municipalities that use the PBSO FBU are understandably discouraged with the DNA backlog and turn around time. In January 2009, the Palm Beach County Law Enforcement Planning Council (LEPC), composed of all Palm Beach County Chiefs of Police, assembled a DNA/Law Enforcement Working Group to investigate options for decreasing the DNA backlog and turn around times. The LEPC members are aware that typically the most labor-intensive process in a DNA laboratory is the screening of crime scene evidence for biological material and is a fundamental factor in the relentless increase of caseload backlogs. If evidentiary samples submitted to the laboratory were prescreened before submission to the FBU, this would have a dramatic affect on reducing FY 2009 Forensic DNA Unit Efficiency Improvement Palm Beach County Sheriff’s Office backlog and turn around time. It is proposed that a central Biology Processing Laboratory (BPL) be developed in an existing space within the Boca Raton Police Services Department (BRPSD) to pre-screen crime scene evidence for southern Palm Beach County law enforcement agencies. The BRPSD BPL will process evidence for the confirmation of blood and semen, determine through microscopic analysis of hair if DNA analysis should be attempted and swab items for touch DNA evidence. All informative evidence will then be submitted to the PBSO FBU unit for DNA analysis. Evidence prescreened at the BPL will be prioritized for PBSO DNA analyst assignment. Grant funding would be used for renovations such as plumbing, flooring, lighting, security, sprinkler systems, telecommunications and information technology systems laboratory screening supplies,

laboratory office supplies, and salaries and benefits for two entry level Laboratory Analysts. The BPL Laboratory Analysts will undergo a comprehensive training program by the Technical Leader of the accredited PBSO FBU. All protocols, forms and laboratory information management systems will mirror the PBSO FBU laboratory and the BPL will acquire accreditation status. The BRPSD will sign a letter of intent to be responsible for maintaining the long-term administrative and financial support necessary to maintain the Biology Processing Laboratory and PBSO will be responsible for long term technical support. Advantages for participating police departments include the agencies will know within days if their evidence may provide a biological investigative lead and if stains should be submitted to the PBSO FBU laboratory for DNA analysis. In addition, the FBU will prioritize per-screened cases thus providing faster casework turn around times and, importantly, the Biology Processing Laboratory will serve as a template for improving DNA case management efficiency other law enforcement regions within Palm Beach County and throughout the country.

FY09 Recipient Name: Massachusetts State Police

Award Number: 2009-DN-BX-K259

Award Amount: \$278,584

**** The grantee declined the award. The Program Office therefore terminated the award and deobligated the funds.**

Abstract: The overall goal is to develop a system to improve the efficiency and capacity of forensic laboratories to process every sexual assault kit submitted for analysis using novel solutions that can be disseminated nationally. The solution is to 1) automate the differential extraction process, 2) integrate all phases of DNA analysis into a single automation-assisted system, and 3) interpret DNA profiles using software systems. It is preferable for the phases to overlap, but they can be validated separately.

Phase I will incorporate a robotics platform to perform both lysis steps (i.e. separation of the non-sperm and sperm fractions) and subsequent implementation of purification methods. An automated Differex™ procedure on the PerkinElmer JANUS® Forensic Workstation will be utilized and four chemistries will be evaluated for purification of the resultant fractions. Phase II entails optimization of the work flow and seamless transfers of data using bioinformatics expertise. Laboratories have purchased hardware/automation to ensure instruments/robots are in place for high volume processing, but normally do not have the personnel in house with the automation and integration expertise needed to efficiently and expeditiously optimize the systems for implementation in casework operations. Months of time are spent struggling with the validation of automated platforms and processes due to this lack of bioinformatics knowledge and experience. Subcontracting this expertise to integrate the processes, program scripts to optimize robot performance, and assist in the validation efforts will provide forensic scientists innovative solutions to seamlessly streamline the processing of sexual assault evidence.

Phase III addresses the resulting bottleneck at the back end of the process that occurs as a result of an increase in productivity at the front end. Data analysis of the DNA profiles derived from sexual assault evidence is often complicated by the fact that such samples consist of mixtures of DNA (i.e. victim, perpetrator and other consensual partners). DNA mixture interpretations are often complex and time consuming. Analysis of the non-sperm and sperm fractions encompasses evaluation of both fractions to infer genotypes and assess the

carry-over components from one fraction to the other. Often, the probative profile has to be deduced by subtracting out the non-probative elements (usually the victims alleles). This process requires skills that require more training and experience, therefore, tasked to the more senior analyst.

The novel solution to address these casework bottlenecks entails the use of software programs that assist in reading the data and inferring genotypes. The software systems can provide a 'genetic calculator' to perform all the requested mathematical functions to assist the reader and/or act as an 'expert system' to review the data with minimal user intervention. Implementation of TrueAllele® Casework software from Cybergenetics would enable laboratories to overcome the 'back end' bottleneck of data analysis and assist in reducing backlogs. The grantee laboratory is currently operating at 50% of the desired capacity to address the processing of sexual assault evidence. The solutions proposed would result in 182% to 364% (i.e. with 1 robot to 2 robot runs per day) of desired capacity to meet and exceed current and future demands. The improvement in efficiency would result in an increase in the number of samples/month/analyst, a decrease in the 'hands-on' time of the analyst leading to a reduction in turn around time and a decrease or elimination of the backlogged sexual assault evidence. The automated methods developed from this endeavor can be implemented in forensic laboratories nationwide to address the global problem of bottlenecks and backlogs.

Overall, this project will result in solving more sexual assault cases, providing closure for victims and their families, and the prevention of future citizens being victimized by sexual predators.

FY09 Recipient Name: Oklahoma State Bureau of Investigation

Award Number: 2009-DN-BX-K160

Award Amount: \$23,783

Abstract: With nearly every state proposing legislative expansion of their CODIS databases, the need to implement the most efficient DNA testing methods possible is paramount. IN addition, with the current economic situation affecting every state, it is equally imperative to develop a cost effective means of performing DNA analysis on these samples. The Oklahoma State Bureau of Investigation (OSBI) has proposed a validation that will provide a solution to both these needs.

The proposal is to validate the use of Applied Biosystem's Identifiler Direct® amplification kit for use on buccal swabs. This innovative procedure will help increase the speed and efficiency with which buccal swabs are processed by eliminating the need for DNA extraction, thus increasing the laboratory's capacity to process more samples, as well as cutting the overall cost of analysis.

OSBI will further demonstrate that any forensic laboratory, regardless of size, can increase current efficiency so they are better prepared to handle an increase in sample submissions without creating a backlog. This will ensure thte CODIS database is utilized to its full potential and that future crimes are prevented to the highest extent possible so the safety and security of citizens is ensured.

This new methodology does not only apply to offender database samples, but can be implemented for use on forensic samples as well. The more efficiency the process is to forensic samples, the more impact it will have on the forensic backlog as well.

The OSBI requests \$23,783 to provide overtime necessary to complete the validation testing, documentation and reporting of analysis results. In return, the OSBI will use agency funds (minimum of \$7,928) to purchase the buccal swab collection kits and the necessary reagents and consumables to complete the validation.

FY09 Recipient Name: University of North Texas Health Science Center At Fort Worth

Award Number: 2009-DN-BX-K171

Award Amount: \$265,393

Abstract: The objective of this project is to create an expert system that will automate the routine and repetitive tasks in interpretation of mitochondrial DNA (mtDNA) sequence analysis, thereby improving laboratory efficiency and the speed of data analysis. Expert system software will be developed to fully automate the analysis of high quality mtDNA data. When the expert system is unable to complete the automated analysis of "challenged data," the software will direct the analyst to the specific area for review and serve as a decision support tool, aiding the analyst in resolving the data and delivering a result, or to direct the analyst for reanalysis. Processing mtDNA sequence data is a time-consuming manual task that requires review by extensively trained and experienced analysts. Several hours of a skilled analyst's time are required to edit and assemble the trace data and generate a type for each sample. In forensic casework, the data must be analyzed independently by two qualified analysts. The independent results are compared and reconciled in order to create the reported profile. Increasing throughput with our development of more automated sample processing and increased sequencing capabilities boosts the subsequent data analysis which mandates the need for a mtDNA sequence analysis expert system.

This project is a close collaboration between forensic science experts at the University of North Texas Health Science Center (UNTHSC) and experienced expert system developers at MitoTech, LLC (MitoTech). The UNTHSC, with support by the National Institute of Justice (NIJ), is a recognized national center for mtDNA analysis especially as it applies to the identification of missing persons and human remains. The UNTHSC has unique expertise in mtDNA sample analysis and is the largest contributor to the U.S. National Missing Persons Program. The UNTHSC Department of Forensic and Investigative Genetics maintains a full service forensic laboratory that is accredited under the requirements of ISO 17025 and the DNA National Standards for DNA Analysis by the Forensic Quality Services - International Division. The UNTHSC Laboratory provides both STR and mtDNA testing to law enforcement agencies throughout the State of Texas, as well as the rest of the United States. The Laboratory for Molecular Identification, located on the UNT Health Science Center Campus in Fort Worth has both a forensic casework division and a research division which has been involved with the development, testing, and validation of several procedures and commercial kits currently used in forensic laboratories and the development of databases used by the forensic community. MitoTech is a small business located in Santa Fe, New Mexico that specializes in developing software systems for statistical and automated data analysis. Recently, scientists at the Federal

Bureau of Investigation worked with MitoTech to improve the standard nomenclature rules that are used to describe the differences between a mtDNA sequence and the rCRS reference sequence [1]. These improved rules, called the Mitotyper Rules, are implemented in a software package that provides for absolute stability and consistency in the type nomenclature. The FBI DNA Analysis Unit 2 has mandated that all future sample types in SWGDAM [1] will be compliant with the Mitotyper Rules. MitoTech has also developed a prototype sequence assembly and editing software package, mtExpert, that is integrated with the Mitotyper Rules. With mtExpert, scientists can edit the mtDNA sequence traces, review the assembly, and evaluate each polymorphism with dynamic links from the traces' base calls through the assembly to the type entries. The current prototype mtExpert software will serve as the platform for additional workflow automation and decision support tools in an expert system that will eliminate the need for analysts to perform the routine repetitive steps in data analysis and export of the mtDNA haplotype.

FY09 Recipient Name: Wyoming Office of the Attorney General

Award Number: 2009-DN-BX-K249

Award Amount: \$412,297

Abstract: The Wyoming State Crime Laboratory (WSCL) is located in Cheyenne, Wyoming, and is the only full service forensic laboratory in the state which provides examinations in Chemistry, Biology, Firearms/Tool marks, Latent Prints/Questioned Documents and Trace. The fundamental mission of the laboratory is to provide, in a timely manner, a full range of forensic services to all local, state and federal law enforcement agencies throughout the state.

Wyoming State Statutes W.S. 7-19-401 through 7-19-406 call for the establishment and administration of a Wyoming State DNA Database and for participation in the NDIS. This *mission critical need* is currently being fulfilled only by outsourcing offender samples to private laboratories using funding from the NIJ. The NIJ is currently also funding staff overtime hours for technical review of the outsourced offender samples. There is currently no equipment or laboratory space at the WSCL dedicated for CODIS sample profiling. We seek to address this *mission critical need* by the establishment of an automated, fully functioning CODIS dedicated laboratory. The NIJ funding through this grant will allow for the purchase of the laboratory testing equipment necessary to achieve this goal.

The Wyoming State Legislature is currently considering, and is expected to pass a bill which will fund the construction of a state laboratory building complex in Cheyenne Wyoming. Included in that building complex is over one thousand square feet of space dedicated to CODIS laboratory and administrative functions. There is currently no pending state funding to address CODIS Unit equipment needs. It is also considered very likely that the Wyoming State Legislature will address the possibility of establishing a database including all arrestee samples during the 2010 legislative session. It is anticipated that once addressed, the 'all arrestee' bill will become law in Wyoming.

The goals and objectives of this project are to *establish and increase the capacity of the WSCL CODIS Unit in order to meet the current and anticipated critical need for an automated and fully functioning CODIS Laboratory by the procurement of dedicated CODIS Unit laboratory*

equipment. This project, upon implementation, will resolve this critical need, which is not currently being met by other funding sources.

This critical need is currently not being completely met under the existing NIJ DNA Backlog Reduction or the CODIS Backlog reduction programs due to the size of the *critical need*. Historically, the DNA Backlog reduction program award limit has been one hundred thousand dollars (\$100,000.00), and the CODIS backlog reduction program award limit has been somewhat less. Though these grants have been extremely helpful in funding the staff overtime and outsourcing necessary to address some backlog and validation concerns, it is not a sufficient amount to adequately fund the equipment for the establishment of a fully functioning CODIS Unit Laboratory.
