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Final Report

Grant Number 1999-DNVX-0015

## An Integrative Program of Unknown Suspect Sexual Assault Case Analysis in North Louisiana

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The goal of this project was to facilitate the investigation of sexual assaults in which a suspect was not identified by the victim (i.e., unknown suspect sexual assault). The first objective was to develop the capacity routinely analyze these cases and enter the forensic DNA profile data into the Combined DNA Index System (CODIS). The second objective was to accumulate DNA profiles from suspects and local arrestees in order to build up a local database of individual DNA profiles for entry into CODIS and to compare the individual profiles with the forensic DNA profiles from the casework. These objectives were accomplished with the assistance provided by funds provided from this grant.

In 2000, 58 unknown suspect cases were analyzed at the North Louisiana Crime Laboratory (NLCL). Twenty-four (41%) had DNA profiles in the sperm fraction which came from unidentified perpetrators. The analysis of the 58 cases cleared the backlog of unknown suspect cases at the NLCL, which resulted in the laboratory being able to analyze new unknown suspect cases within 60 days of the initial evidence submission. The backlog reduction was achieved by using the equipment enhancements and supplies purchased with funds from this grant. The supplies and equipment realized from this grant were also used to work additional unknown suspect cases in 2001. An additional twelve cases have been completed of which four had foreign DNA profiles. Eighteen other 2001 unknown suspect cases are in progress and twenty are waiting to be started.

In addition to the regular unknown suspect cases, six other unknown suspect cases were worked separately because of a special investigative need by law enforcement agencies. These six cases were worked individually because there was an immediate need for investigative information concerning a serial rapist. All six of the cases were linked to a single perpetrator. In summary, 96 unknown suspect cases will eventually be worked using supplies and equipment received in the grant.

Another component of this grant, which helped eliminate the backlog, was the development of methods that expedited the analysis of unknown suspect cases. The ability to work these cases within 30 days after submission would provide rapid investigative information to law enforcement officers and could enhance their ability to identify and arrest suspects before they committed more crimes. Developing a protocol which greatly expedited the analysis of unknown suspect cases would help a laboratory maintain timely case analysis. Using Qiagen DNA purification columns, a protocol was developed which allowed rapid analysis of unknown suspect sexual assault cases. The NLCL has developed and validated a DNA extraction protocol using Qiagen columns to rapidly purify DNA from reference samples and epithelial fractions from the sexual assault cases worked during part of the grant period. Unknown suspect cases, submitted in 2001, are being worked using the Qiagen columns on reference samples and the epithelial fractions of the differential extractions.

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The use of Qiagen columns for purifying the DNA extracts has significantly reduced the time required for analysis. The previous protocol used phenol-chloroform (PCIA) purification, which often required more than one day to complete purification with extensive analyst involvement. PCIA purification also uses more supplies and generates considerable biohazardous waste. The Qiagen purification has reduced the analysis time to less than one hour and also substantially decreased the dangerous waste products of PCIA purification. Using non-hazardous chemicals was beneficial to the analysts because their exposure to dangerous reagents is reduced. For the greatest sensitivity and reliability, the sperm fractions of the differential extraction were still purified using PCIA-based procedure.

The NLCL also developed and validated a protocol for rapid extraction of DNA from reference samples using the Qiagen columns. The new protocol processes up to 10 samples in less than one hour and can process larger groups of samples, if necessary. The limit of 10 samples was selected to reduce the chance of sample mix up and the fact that most analysts doing casework seldom extract more than ten reference samples at one time. This procedure can also be automated using a robotics platform. The use of automated robotics technology for DNA purification is being pursued by the NLCL as a means of analyzing of reference samples, local arrestee samples, and unknown suspect casework.

Enhancement of the equipment at the NLCL also contributed to the timely analysis of the unknown suspect case samples and reference samples. One ABI 377 DNA Sequencer was upgraded to analyze up to 96 samples on a gel. The upgraded ABI 377 has been used to run 48 samples from unknown suspect cases, thereby increasing the throughput by 50%. The increased number of samples which can be run on a single gel allowed analysts to process a batch of unknown sexual assault cases and the associated reference samples for both AmpFISTR™ Profiler Plus and AmpFISTR™ COfiler in a single run. A batch of five unknown suspect rape kits can now be processed in four days.

The second objective was to analyze DNA samples from local arrestees and develop protocols which expedited these analyses. Although Louisiana did not promulgate rules for collecting samples from persons arrested for certain crimes. The crime lab used the method to analyze reference samples for police departments, as well as screening large numbers of samples from suspects in a series of sexual assaults and burglaries. The crime lab had previously impressed upon the local law enforcement officers about the need for reference samples. The laboratory did this in two ways. First, the crime lab provided agencies with C.E.P. swabs and then taught the officers the method used to collect buccal swabs. The law enforcement officers were thrilled with this type of sampling and responded by providing suspect reference samples as part of the initial evidence submission. The submission of all reference samples in a case allows the analyst to process and complete cases more rapidly by not having to hold the case open while waiting for additional samples. Suspects were asked to consent to sampling during initial interrogation at the police station. The police officers did not have to find a laboratory technician to collect blood samples or remove the suspect from jail to have the sample collected. In 2000, and to date in 2001, 515 reference samples were collected and typed using Short Tandem Repeat DNA technology.

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The police officers also used the buccal swabs to sample a large number of individuals as part of an investigation to identify a serial rapist. This laboratory was able to process over fifty of these samples for the police. The screening process by the police department is still going on, and more samples are being submitted weekly. The capability of the laboratory to quickly process these samples, which was developed as part of this grant, has provided useful investigative information to the police department in a timely manner, although at this time the identity of the rapist has not yet been determined.

As part of the objectives for this grant, the DNA profiles obtained from the unknown suspect cases and arrestees were to be entered into the Combined DNA Index System (CODIS). At the end of 2000, the CODIS computer equipment had not been delivered to this laboratory. However, in March of 2001, the CODIS computer and software were installed at the Shreveport laboratory. Within one month, all of the unknown suspect DNA profiles were entered in the system along with all of the suspect profiles. The DNA profiles which were entered also included unknown suspect cases submitted since 1995. Currently, there are 95 forensic STR profiles, 39 forensic mixture profiles, and 133 known suspect profiles in the local database (CODIS). The computer system has not been connected to State or National systems, but is expected to be connected by the end of 2001.

Local searches were performed after entering the DNA profiles and several hits were obtained. However, these hits had been previously identified before being entered into the system. The only unexpected hit came when a local gang member was killed and his DNA profile was searched against the forensic unknowns and mixtures. His profile matched that of a previously worked unknown suspect sexual assault. The match provided an investigative lead to deputies investigating the case, because information developed by the police suggested that he was killed because he raped someone's sister.

The NLCL also developed a rapid method of quantifying DNA using fluorometry and PicóGreen<sup>®</sup> stain. This procedure allowed the amount of DNA in selected samples to be rapidly quantified when the question of human or non-human was not an issue. This method was also able to use some newly developed methods for quantifying human DNA by luminometry. DNA quantitation methods based on luminometry also hold promise for quantifying human DNA. Additional work is underway to validate this method for routine use in quantifying DNA from reference samples.

In conclusion, the North Louisiana Crime Lab developed and successfully used an integrated program to analyze unknown suspect sexual assault cases. This program developed protocols which expedited analysis of unknown suspect cases, as well as typing reference samples from suspects. In the last year since the program was instituted, it has eliminated the backlog of unknown suspect cases, provided a rapid method of analyzing these cases, and provided a means of rapidly analyzing reference samples.

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