

**Sub-Category A-vi:
Forensic and Investigative Methods**

COMPENDIUM OF RESEARCH ON VIOLENCE AGAINST WOMEN

1993-2020

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Category A: JUSTICE & RELATED SYSTEMS

vi. Forensic and Investigative Methods

1997-WT-VX-0008:	Medical Records as Legal Evidence of Domestic Violence
Amount:	\$164,025
PI:	Nancy Isaac
Status:	Completed

This existing researcher-practitioner partnership involving legal, medical and victim advocacy communities will evaluate the utility of medical record information as evidence of domestic violence. The project will quantify the proportion of battered women's medical charts that provide adequate documentation of abuse (by legal standards), and will enumerate the types and prevalence of various flaws in documentation. The empirical analysis will be based on a review of the medical records of a prospective series of 100 domestic violence victims assisted through the Law Clinics of the Northeastern University School of Law, in Boston, Massachusetts. For each client, all medical charts that may reflect abuse will be obtained and a semi-structured clinical interview will be performed to detail the woman's self-reported history of abuse.

Product: NCJ# 188564

Documenting Domestic Violence: How Health Care Providers Can Help Victims (2001) – N. Isaac, P. Enos

This study described from a legal perspective, how domestic violence is being documented in abused women's medical charts. Ninety-six medical charts of 86 battered women covering 722 visits were reviewed. The subjects were referred through a law clinic and partnering organizations that serve battered women. In 24% of these visits, detailed information was abstracted on the medical record documentation because of an indication of domestic violence, or injury, or both. The study found significant shortcomings of current medical charts as legal evidence including poor handwriting, insufficient use of photographs and body maps, the use of legal jargon that could damage the victim's case such as alleged abuser, failure to use excited utterances (an exception to the hearsay rule) in medical history-taking, and to document details of the incident such as the name of the perpetrator, the time and place of the assault, and the demeanor of the victim. The study contains recommendations regarding relatively minor changes that could be made in record-keeping that would substantially enhance the value of medical records as legal evidence in domestic violence cases. Such records could even be used in the absence of direct testimony from the medical provider.

Additional NCJ Citations: 184528, 184530, 195076

1998-WT-VX-0027:	Impact Evaluation of a SANE Unit in Albuquerque, New Mexico
Amount:	\$262,853
PI:	Cameron Crandall
Status:	Completed

The project will conduct a comprehensive impact evaluation that will address four areas; victim advocacy, law enforcement, prosecution, and health care services, devoting considerable attention to their interconnectedness. The evaluation will use a quasi-experimental design, comparing perceptions before and after the implementation of the collaborative. Project researchers will measure the impact of programs in the four areas of interest, using a variety of techniques, including telephone and mail surveys; review of case files, court records, and medical charts; and semi-structured interviews. To foster ongoing collaboration on UNM researchers with community leaders, key individuals from the four interest areas will be identified and invited to attend collaborative meetings with investigators. The project will conduct a stratified random sample of adult women, ages 18 and older at the time of the survey, who have received SANE services at the Albuquerque Collaborative. To provide a measure of comparison, the project will collect data from a group of historical controls. Analysis procedures will include several standard statistical techniques, including both standard non-parametric and parametric techniques such as the Wilcoxon rank sum chi-square and t-test procedures will be used to test statistical significance. Qualitative data will be compiled and analyzed using content analysis methods.

Product: NCJ# 203276

Impact Evaluation of a Sexual Assault Nurse Examiner (SANE) Program (2003) – C. Crandall, D. Helitzer

The experiences of women who sought services at the University of New Mexico Health Sciences Center in the two

years prior to the inception of SANE (1994-1996) were compared with the experiences of women who sought services at the Albuquerque SANE Collaborative after inception (October 1996) through the end of 1999. Information was also obtained from 28 key informants. Ten qualitative and quantitative methods were used. Qualitative methods included an advocate focus group, victim services interviews, health care interviews, law enforcement interviews and prosecution interviews. Quantitative methods included reviews of pre-SANE medical charts, SANE medical charts, law enforcement records, and a victim telephone survey. Post SANE victims received more medical services for sexual assaults and a greater number and more comprehensive referrals to victim services. More SANE victims reported to police, and had more evidence kits collected. Police filed more charges post SANE, had higher conviction rates and longer sentences. The data strongly suggest that a SANE unit greatly enhances the healthcare quality of women who have been sexually assaulted, improves the quality of forensic evidence, improves law enforcement's ability to collect information and to file charges, and increases the likelihood of successful prosecution.

2000-WT-VX-0014:	An Intervention to Improve Documentation of Domestic Violence in Medical Records
Amount:	\$220,817
PI:	V. Pualani Enos
Status:	Completed

This project will develop, implement, and evaluate a protocol and practitioner training intervention that will improve documentation of abuse in health care settings. The project's goal is to increase the frequency with which the medical charts of abuse victims contain information that can be used to their legal benefit. The training intervention will be based on prior research findings and will be informed by the expertise of an interdisciplinary practitioner-researcher partnership and by focus groups of survivors and medical providers (e.g., physicians, nurses, and social workers). In the early stages of the project, three sets of focus groups will provide information for effective training. The process evaluation will provide a complete description of how many sessions of the intervention were delivered, with what content, and to which audience. For the impact evaluation, post-intervention sessions will be assessed at each intervention site and will be compared to a series of pre-intervention records. The charts of women who have documented DV will be reviewed and information will be abstracted using a tool developed in the previous research project.

Product: NCJ# 207146

Intervention to Improve Documentation of Intimate Partner Violence in Medical Records (2004) – V. Paulani Enos, J. Linden, L. Tieszen, J. Bernstein, J. Brown

This project developed, implemented, and evaluated an intervention designed to improve the abuse documentation practices of health care providers by encouraging them to apply diagnostic and documentation skills traditionally understood to fall within the medical realm of professional competence and responsibility. This project builds upon the previous work of a unique medical-legal, researcher-practitioner collaboration by addressing assessment and response to IPV in medical setting and then developing a training program focused primarily on the documentation of intimate partner violence. The research team developed a training that presented a recommended response to IPV that emphasized documentation employed a patient empowerment model and relied on an interdisciplinary team approach. The curriculum development was conducted through focus groups with emergency medical technicians, paramedics, nurses, and residents from each study site. A separate focus group was conducted with IPV survivors, IPV advocates, social workers, and hospital administrators. The curriculum development team formulated a 50-minute training for each provider group using a team-based approach that describes the benefits of a health care response to IPV, presents concrete strategies for assessment and documentation of IPV, and details a limited intervention that all providers can deliver within a 5-minute interaction regardless of patient disclosures or readiness to take action. The findings related to the effectiveness of the training remain inconclusive due to the small number of IPV records written by providers who had attended the training. While some changes in practices did occur, further study of the intervention is needed to fully ascertain its potential. The evaluation speaks to the feasibility of IPV training in an emergency medical setting and the challenges related to evaluating provider practices.

2002-WG-BX-0007:	Criminal Justice Effects of Rape Services
Amount:	\$159,614
PI:	Peg Langhammer & Andrew Klein
Status:	Completed

Various rape law reforms and rape service reforms have been initiated since the 1960's. The intersections of these reforms can provide critical points of leverage in the judicial pursuit of rape accountability. Ideally, the forensic exam, accompanied by support of the police command structure, effectively standardizes the development of rape evidence and the early involvement of victim services and the prosecutor. Unfortunately, there have been few rigorous studies of the effects of these services. The current view is that, taken together, studies have shown limited reform effects. Studies of the criminal justice effects of rape services have been anecdotal and unsupported by case outcomes data. The Sexual Assault and Trauma Resource Center of Rhode Island (SATRC) in partnership with BOTEK Analysis Corporation is undertaking, during a two-year study period, an evaluation of the criminal justice outcomes of the sexual assault response team initiated by SATRC. A quasi-experimental comparative change design is proposed. It is hypothesized that an integrated, interagency sexual assault response team will produce higher rates of criminal investigations, arrest and convictions.

Product: NCJ# 210584

An Evaluation of the Rhode Island Sexual Assault Response Team (SART) (2005) – D. Wilson, A. Klein

The SART process in Rhode Island is a coordinated effort between the victim, the Sexual Assault Trauma Resource Center (SATRC), the police department, and the Rhode Island Department of the Attorney General. The SART program was initiated in January 2002. The evaluation covers assaults from September 2002 through August 2003, which includes 238 sexual assaults. These cases were followed until July 2004. The program has demonstrated positive effects as there is demand among sexual assault victims for SART services. Victims who seek SART services have significant odds of being assaulted by a friend, acquaintance or relative, have had a subsequent forensic exam, and believe that the offense was first degree sexual assault. The evaluation found that the estimated probability of a victim choosing to be a SART client, whose assault is without these assault characteristics and the police find probable cause is 3%, while the probability of a victim seeking SART services with all of these assault characteristics and the police do not initially find probable cause is 89%.

2003-IJ-CX-1027:	Visiting Fellowship Program: Police Investigation of Rape: Roadblocks and Solutions
Amount:	\$149,942
PI:	Martin Schwartz
Status:	Completed

The project will look into the views of police officers on the frustrations and obstacles to the successful completion of a rape investigation. Through a survey methodology at least 150 patrol officers and sheriff's deputies will be queried about the problems inherent to rape investigations, and their responses will be examined against a highly validated rape myth scale. They will then be asked for their views on ways that they or others have overcome these obstacles and successfully completed investigations. The second group to be studied will be 25 experienced investigators, who will be asked similar questions, only in a qualitative format in more depth and covering more issues, such as female offenders, false reports, false confessions, male victims, and lesbian rape. These investigators will be asked about marginalization, stress, time management, and other problems. They will be asked what techniques that they use in addition to basic police work, such as team investigation or profiling. The goal of this research is not only to discover what police officers themselves see as the problems that they have in carrying out their duties but also to highlight their successes in overcoming problems.

Product: NCJ# 232667

Visiting Fellowship Program: Police Investigation of Rape: Roadblocks and Solutions (2010) – M.D. Schwartz

One conclusion from the findings is that most police officers, whether detectives or first responders, are aware of the basic, well-known "rape myths" and the "politically correct" answers that challenge those myths; for example, they know that women who dress revealingly can be raped, that women can be raped by men with whom they have previously had consensual sex, and that it is wrong to assume that women share some blame for being raped. Still, the findings from administering the rape scale to the officers indicate that, despite many years of training, a large number of police officers still hold attitudes and opinions that undermine their ability to treat rape victims well. The officers were almost unanimously opposed to changing to a system of investigation and case processing that gives priority to protecting victims. Although this study had the objective of identifying "best practices" in police investigations of rape, the study concludes that there are no "best practices" worthy of replication or widespread use. Among the police officers in this study, there was virtually no interest in and some strong resistance to examining innovative and improved ways of investigating and managing rape cases. The dominant theme in current investigative techniques is

the presumption that victims are lying and that the initial job of the investigators is to expose it. The study recommends that police training in rape investigations be based on solid research and be related to the types of cases most often encountered, i.e., acquaintance rapes rather than stranger rapes. Interviews were conducted with 49 detectives who specialized in sexual assault. Samples of campus and municipal police officers were included in interviews with first responders.

2003-WG-BX-1003:	Testing the Efficacy of the SANE-SART Programs
Amount:	\$275,000
PI:	M. Elaine Nugent
Status:	Completed

The goal of the study is to establish the efficacy of SANE-SART as a tool in the criminal justice system. Primary research objectives are to determine whether SANE-SART interventions have an impact on rates of arrest, prosecution, and conviction. The research will also examine whether SANE-SART involvement has an impact on the frequency of guilty pleas, the charges at case disposition, and sentencing. From the population of adult female rape cases reported to the largest law enforcement department in each jurisdiction, the research team will select a random sample comprising equal numbers of SANE-SART and non SANE-SART cases. Data will then be drawn from case records on the dependent variables of criminal justice outcomes, and on selected intervening or control variables that may impact on outcomes, including relationship between perpetrator and survivor, length of time between incident and report, race of survivor and perpetrator, use of weapons, perpetrator’s prior criminal record, and survivors’ participation in the process. Study findings will contribute to the discussion concerning the expansion of SANE and SART programs to jurisdictions that do not have these programs currently. In addition, it is hoped that those locations that do have the programs will be able to use the results to improve and enhance existing efforts.

Product: NCJ# 214252

Testing the Efficacy of SANE-SART Programs: Do They Make a Difference in Sexual Assault Arrest and Prosecution Outcomes? (2006) – M. Nugent-Borakove, P. Fanflik, D. Troutman, N. Johnson, A. Burgess, A. Lewis O’Connor

The goal of this study was to test the efficacy of SANE-SART programs as a tool in the criminal justice system. The American Prosecutors Research Institute and Boston College tested whether SANE-SART exams increase arrest and prosecution rates for sexual assault. Five questions were asked: 1) is the arrest rate higher in cases where a SANE-SART exam is performed when compared with cases in which no exam is performed; 2) is the indictment/charging rate higher in such cases; 3) are guilty pleas more likely to be entered in such cases and are pleas likely to be to the existing charge or to a lesser charge; 4) is the conviction rate higher in such cases; and 5) is the sentence more severe in such cases. The project team randomly selected up to 125 sexual assault cases in which there was a SANE or SART intervention and 125 cases in which there was no SANE-SART intervention—which resulted in a total of 262 SANE-SART cases and 268 non-SANE-SART cases. Case information was collected from SANE-SART prosecution files in Monmouth County, NJ, Sedgwick County, KS, and Suffolk County, MA. The results indicated that compared to non-SANE-SART cases, SANE-SART cases are reported more quickly, have more evidence available (particularly DNA), and have more victim participation. SANE-SART intervention: a) was a factor in the identification and arrest of a suspect; b) the strongest predictor that charges will be filed; and c) helped increase the likelihood of a conviction. Insufficient information was available to determine the impact of SANE-SART intervention on penalty and length of sentence. Overall, the findings are supportive of SANE-SART programs and their efficacy as a tool in the criminal justice system.

2005-WG-BX-0003:	A Systems Change Analysis of SANE Programs
Amount:	\$389,925
PI:	Rebecca Campbell
Status:	Completed

The proposed project adds to the current literature by determining the circumstances and contexts under which SANE programs increase prosecution by identifying the mediating mechanisms that explain how and why SANE programs affect case outcomes. Using a systems change theoretical perspective, the proposed project has the following five objectives: It will (1) compare prosecution charging rates and court outcomes for cases examined in a SANE program (intervention group) to a sample of adult sexual assault cases examined using standard hospital protocols in the same community prior to the implementation of the SANE program (comparison group); (2) identify victim, case, and

forensic medical evidence characteristics that predict prosecutors’ charging decisions; (3) examine SANEs impact on police as a mediating pathway to increased prosecution rates; (4) explore how the emotional support provided to victims/survivors by the SANE program and victim advocates increased their participation during investigation and prosecution; and (5) create a practitioner-oriented program evaluation toolkit that can be used by other communities to assess post-SANE systems change. A series of studies are planned to address these objectives, which will include rigorous quantitative, quasi-experimental designs and in-depth qualitative interviews with prosecutors, police, and victims/survivors. This study will examine the interrelationships between SANEs, legal professionals, victim advocates, and victims/survivors, as these linkages may be critical in explaining how and why SANE programs increase prosecution rates.

Product: NCJ# 226497

Systems Change Analysis of SANE Programs: Identifying the Mediating Mechanisms of Criminal Justice System Impact (2009) – M. Greeson, R. Campbell, S. Kobes

The first goal of this project was to determine whether adult sexual assault cases in a Midwestern community were more likely to be investigated and prosecuted after the implementation of a Sexual Assault Nurse Examiner (SANE) program, and to identify the “critical ingredients” that contributed to that increase. The second goal of this study was to understand why there was an increase in criminal justice system case progression after the implementation of the SANE program. This twelve year analysis of criminal justice system case outcomes revealed that more cases were moving through the system to higher levels of disposition (i.e., guilty pleas or guilty convictions) after the implementation of a SANE program. The authors were able to conclude that these effects are reasonably attributed to the efforts of the SANE program and not due to other changes over time in this community. The SANE programs’ work with law enforcement and their patients, though separate and philosophically distinct, is mutually reinforcing and provides instrumental resources for successful case prosecution.

Product: NCJ# 226499

Step-by-Step Practitioner Toolkit for Evaluating the Work of Sexual Assault Nurse Examiner (SANE) Programs in the Criminal Justice System (2009) – M. Greeson, R. Campbell, S. Kobes

Based on the findings of NCJ #226497, the authors developed a practitioner-oriented Toolkit. This Toolkit outlines a step-by-step process for other communities to assess what kinds of changes have taken place post-SANE and what factors are most critical in their communities that attributed to that success. The goal of this Toolkit is to assist SANE program staff in evaluating how their program affects the reporting, investigation, and prosecution of sexual assault cases in their community. The focus of this Toolkit is the impact of SANEs on the progression of sexual assault cases through the criminal justice system.

Additional NCJ Citations: 226498, 228354, 228355

2005-WG-BX-0010:	Developing, Testing, and Evaluation of the Use of Polygraphs to Combat Violence Against Women
Amount:	\$324,877
PI:	Douglas Wilson
Status:	Completed

DeKalb County Georgia Probation Department is developing an innovative program to test the application of polygraph technology to supervise, contain, and treat high risk misdemeanor abusers who are in the community. This 24-month experiment will have three parts: Phase I will initiate the implementation of the program and the random assignment of batterers to experimental (polygraph) and control (no polygraph) groups, and pre-test the operation of the program with a small number of polygraph tests with appropriate probationary follow-up; Phase II (operations) will last until the 18th month. It is expected that 240 high risk offenders (120 treatment and 120 controls) will be identified by DeKalb Probation, assigned to the cooperating batterer treatment program (Riveros Counseling Services), and their victims interviewed by the Victim Liaison employed by Riveros, Court procedures applied to both groups will remain unchanged to avoid confounding the outcomes (measures of post-conviction criminal behavior will include interview data from victims and criminal record data; and Phase III (analysis) will involve analysis of process and outcome data, using cross-tabulations, survival analysis, and logistic regression.

Product: NCJ# 222115

The findings indicate that polygraph testing can assist probation departments in managing the risky behaviors of domestic-violence probationers who have an elevated risk of repeated criminal behaviors as specified in this study

(illegal drug use other than marijuana; the possession or handling of firearms; and involvement in additional physical abuse, regardless of gender). The polygraph's identification of these risky behaviors predicted subsequent arrests within the study period. Such polygraph findings can inform appropriate interventions that can modify the risky behaviors. Thus, the use of polygraph testing for high-risk, domestic-violence probationers can assist in interdicting specific behaviors in supplementing curricula of family violence programs. For this study, the DeKalb County State Court Probation Department (Georgia) identified 321 high-risk, domestic violence probationers who had a mix of previous violent and nonviolent misdemeanor convictions. These probationers were allocated to a family violence intervention site and 10 analogous control sites in the county. At the conclusion of 1 month of psychoeducational classes, the treatment facilitator asked the enrolled men if they would volunteer for a polygraph test and, if they continued their enrollment, asked them again to take a second polygraph test at the end of the fourth month of classes. The treatment and control group samples balanced the demographic and criminal characteristics of the men at the treatment site and control sites across 11 demographic and criminal-record variables. Forty-three of the 87 men assigned to the treatment site completed at least 1 polygraph. (7 tables, a 26-item bibliography, and appended Victim History of Domestic Violence Survey)

2006-DN-BX-0094 (Supplement): Sexual Assault Kit Backlog Study

Amount:	\$100,000
PI:	Joseph Peterson
Status:	Completed

Although law enforcement and hospitals have improved and expanded procedures to gather SAK evidence, scientific resources and procedures to test such evidence have not kept pace, and the resulting backlog of untested SAKs has become a major problem throughout the United States. In 2008, the untested SAKs in the city and county of Los Angeles reached 10,895. In 2009, the city and county law enforcement agencies announced that all backlogged kits would be tested. The untested sexual assault kit problem in Los Angeles, coupled with the fact that agencies had decided to test all such kits for the presence of DNA evidence, presented a unique research opportunity. The Sexual Assault Kit Backlog Project at CSULA was funded by NIJ in 2009. The two primary goals in the L.A. study were to look at a random sample of nearly 11,000 kits to (1) assess the efficacy of DNA testing and (2) determine the criminal justice outcomes (arrest, charge, conviction) within the first 6 months after the kits were DNA tested. The findings with respect to the study's second goal were surprising to many. In a randomly selected sample of 371 SAKs, there were no new arrests, new charges were filed in one case, and there were two convictions in the first 6 months after these kits were tested. In fact, it is probable that the DNA testing was not responsible for the single filing or the two convictions.

Product: NCJ# 238500

Sexual Assault Kit Backlog Study (2012) – Joseph Peterson, Donald Johnson, Denise Herz, Liza Graziano, Taly Oehler

Although law enforcement and hospitals have improved and expanded procedures to gather SAK evidence, scientific resources and procedures to test such evidence have not kept pace, and the resulting backlog of untested SAKs has become a major problem throughout the United States. In 2008, the untested SAKs in the city and county of Los Angeles reached 10,895. A study to document reasons for these untested kits found a number of organizational and resource deficiencies. Primarily, they were not the result of crime laboratory backlogs but were untested because investigators and prosecutors had not requested that they be tested. In 2009, the city and county law enforcement agencies announced that all backlogged kits would be tested. The untested sexual assault kit problem in Los Angeles, coupled with the fact that agencies had decided to test all such kits for the presence of DNA evidence, presented a unique research opportunity. The Sexual Assault Kit Backlog Project at CSULA, funded by the NIJ in 2009, was to accomplish four primary objectives: (1) to evaluate the results of scientific tests performed by private laboratories on backlogged SAK evidence from the LASD and LAPD crime laboratories; (2) to review the sexual assault case-processing literature and the role played by evidence and other factors in solving and prosecuting such cases; (3) to determine the criminal justice dispositions of a sample of backlogged and non-backlogged cases before and after kit testing; and (4) to identify principal case and evidence characteristics that could be used by forensic laboratories to evaluate and prioritize sexual assault evidence submitted to crime laboratories. The accomplishment of these goals would aid all law enforcement agencies and crime laboratories about the value of testing backlogged SAKs and set guidelines for processing such evidence in the future.

Additional NCJ Citations: 243685, 238483, 239709, 231977

2007-WG-BX-0003:	A Statewide Study of Stalking and Its Criminal Justice Response
Amount:	\$182,738
PI:	Andrew Klein
Status:	Completed

The study will explore the impact of identifying and charging for the crime of stalking in the state of Rhode Island on offender accountability as measured by successful prosecution as well as victim safety, as measured by re-arrest for domestic violence within two years. Researchers will use a multi-methods approach that includes secondary data analysis of a mandated law enforcement reporting system as well as court based data regarding prosecution and qualitative interviews with select Rhode Island law enforcement officers, prosecutors, defense lawyers and court advocates for a more complete understanding of the factors influencing the criminal justice response to stalking. The researcher plans to explore answers to the question, “Does identifying the crime of stalking have an effect on prosecution outcomes, as well as longer terms outcomes in regard to subsequent arrests for domestic violence?” A sample of 1,297 incident and arrest reports where citations have been made by police for threats and harassment between January 1, 2001, and December 31, 2005, will be reviewed to extract those cases where stalking charges should have been brought against the suspects. These extracted cases will be compared with 140 cases during the same period where the suspects were actually cited for stalking. Comparisons will be made on a variety of characteristics, with the end result being the development of a more complete profile of stalkers. Qualitative interviews (group) with 30 key informants from smaller cities in Rhode Island will be conducted to assess factors that may influence the criminal justice response to stalking.

Product: NCJ# 228354

A Statewide Study of Stalking and Its Criminal Justice Response (2009) – A. Klein, A. Salomon, N. Huntington, J. Dubois, D. Lang

The study found that when police identified stalking in a domestic violence case, the offender was more likely to be arrested and prosecuted, compared with domestic violence cases in which stalking was present but not identified by police. In addition, stalkers of intimate partners without prior criminal histories who were identified by police in reported domestic violence cases were significantly less likely to be charged with new domestic violence up to 6 years after police intervention; however, the criminal justice response to stalking was compromised by the under-identification of stalkers by police, compounded by prosecutors’ charge reduction and case dismissals when police did make stalking arrests. Police, prosecutors, and judges have tended to view intimate stalkers as less dangerous than stranger stalkers or abusers arrested for physical assaults. This view was contradicted by the study's finding that victims of domestic abuse who were stalked by their former partners were more likely to report threats as well as prior assaults. This should encourage police to focus on determining whether the crime of stalking is involved in a reported domestic violence case. The study, which was conducted during 2007-2008, used a mixed-methods design. The quantitative component compared all stalking incidents identified by Rhode Island State police between 2001 and 2005 with a sample of reported domestic violence cases over the same years that involved stalking but did not involve stalking charges being brought by police.

Additional NCJ Citations: 228355

2007-WG-BX-0011:	Testing the Efficacy of Judicial Monitoring: A Randomized Trial at the Rochester Domestic Violence Courts
Amount:	\$335,208
PI:	Melissa Labriola
Status:	Completed

While judicial monitoring has been shown to be effective with other criminal justice populations, few studies, and none involving a randomized control design, have been conducted with domestic violence offenders. This study will fill this gap through a randomized trial to determine the efficacy of a carefully designed, robust model of judicial monitoring. In addition to examining the impact of monitoring on official recidivism and victim reports of re-abuse, the impact on intervening offender perceptions regarding the swiftness, certainty, and severity of further sanctions in response to violations of the court’s orders will also be examined.

Product: NCJ# 247161

Testing the Efficacy of Judicial Monitoring: A Randomized Trial at the Rochester (2012) – Melissa Labriola, Amanda B. Cissner, Robert C. Davis, Michael Rempel

As used in this study, judicial monitoring is “frequent ongoing court appearances to verify and motivate offender compliance” with court-mandated conditions. Overall, the findings do not generally support the positive impact of judicial monitoring, even though such monitoring has been shown to be effective with other offender populations; however, there was some evidence that, under certain circumstances, judicial monitoring may increase compliance with court mandates. Regarding the impact of judicial monitoring on offender behavior, the study determined that assignment to judicial monitoring did not have a significant impact on re-arrests, program attendance, or program completion. Regarding its impact on offender perceptions, judicial monitoring was associated with offenders being significantly more likely to believe they understood their obligations, that there would be consequences for noncompliance, and that the consequences would be severe, compared to offenders not assigned to judicial monitoring. Offenders sentenced by the judge who opted not to incentivize achievements through reductions in monitoring frequency attended significantly more program sessions and were also more likely to complete assigned programs than offenders sentenced by the other judges. This tentatively suggests that domestic violence offenders benefit from more frequent monitoring (e.g., biweekly) and from not expecting to receive praise or other incentives for following court orders. Higher scores on two of the offender perception indexes (i.e., perceptions of the consequences of noncompliance and perceptions of procedural justice) were significantly associated with attending more batterer program sessions. In addition, a higher score on the severity of response index (expecting a more severe response to noncompliance) was significantly associated with attending more substance abuse treatment sessions.

2008-DN-BX-K220:	Stranger Rape Analysis Project
Amount:	\$914,471
PI:	Don Pierce
Status:	Closed

This project focuses on the implementation of the quick- turnaround DNA testing pilot project, which uses public-private partnerships to increase the clearance rate for stranger rapes and sexual assaults. The project coordinator will contact every law enforcement agency and the detectives who process rape cases to educate them about the program and its processes. Information and training about the program will also be given to community based and system based sexual assault advocates and to sexual assault nurse examiners at local hospitals. After a stranger rape occurs that meets the criteria established by a group of stakeholders, a DNA sample will be obtained. The sample will be sent to a private laboratory operated by Orchid Cellmark for processing. The sample will be tested and the results returned within 30 days. The DNA analysis will be submitted to the Washington State Patrol Crime Laboratory for quality assurance testing. The Crime Lab will submit the results to state and federal DNA databases. Any resulting matches will be reported to the originating law enforcement agency. Case outcome data will be collected and analyzed in order to determine the effect of this quick turnaround DNA analysis policy.

2009-DN-BX-0023:	Post-Coital DNA Recovery
Amount:	\$763,428
PI:	Patricia Speck
Status:	Completed

In most jurisdictions, post-coital samples are collected up to, but not after, 72 hours following rape. Today, recovery and analysis is improved through DNA technology — identifying individuals from sperm found 7 days after coitus. The goals of this research are to answer: (1) what is the time frame for sperm recovery post-coitus using Y-STR laboratory methods, and (2) what are physiological conditions that may impact recovery of DNA in post-coital samples? The objective of this research is to provide evidence to support or limit the expansion of the 72-hour time frame for evidence collection from the vagina and cervix after a rape event in adult females. A convenience sample of 300 sexually active heterosexual female forensic RNs older than 18 years of age with normal menstrual cycles will be asked to enroll in the study over a 3-year period of time (Year 01: ages 18-35; Year 02: ages 36-55; Year 03: older than age 55). Before the target coitus, the RN subject will abstain or use barrier methods 7 days prior to coitus. She will evaluate the appearance of her vulva/hymen and will answer online questions about her overall reproductive health and sexual activity. Before coitus, the RN will collect samples from her partner’s cheek and her proximal vagina and cervix as controls. After coitus, samples will be collected at 3, 5, 7, 9 and 12-15 days post-coitus. She will abstain or use barrier methods throughout the 2-week collection period. Samples will be mailed directly to the National Center for Forensic Science DNA laboratory for indexing and Y-STR DNA analysis. This study will provide evidence necessary (or not) for expansion of the time for SART programs nationally.

Product: NCJ# 248682

Post-Coital DNA Recovery Study (2015) – P. Speck, J. Ballantyne

The study found that standard Y-STR methods are insufficient to detect DNA from both the cervix and posterior formix at all post-coitus data collection times at 4, 7, and 9 days and a baseline of 10 days; however, strong data shows the use of enhanced Y-STR-enabled DNA identification from cervix and posterior formix through the first post-coitus menstruation. An association was found between diminished DNA recovery and menstruation and the use of hormonal birth control. Of 112 consenting monogamous couples, 66 completed all phases of the study protocol. Eligible participants provided consents, eligibility data, and agreement to complete a diary during four 10-day abstinent periods and collect post-coital samples at baseline and at 4, 7 or 9 days. Upon protocol completion, participants mailed samples to the forensic laboratory for Y-STR methods analysis. Secure physical environments and blinding of laboratory personnel and statisticians to all participants’ information protected their personal health information.

2009-MU-MU-0002:	Implementation of a Sexual Assault Nurse Examiner (SANE) Practitioner Evaluation Toolkit
Amount:	\$413,467
PI:	Rebecca Campbell
Status:	Completed

The purpose of this proposed project is to conduct an implementation evaluation of the SANE Practitioner Evaluation Toolkit. These evaluation data will be used to create a revised Toolkit and technical assistance guidelines to support national dissemination. Investigators will use stratified, national random sampling to identify five SANE programs that have organizational readiness to participate in program evaluation. They will then guide these pilot programs through the seven evaluation steps in the Toolkit (located on NCJRS). This project has three objectives: (1) They will test five different technical assistance (TA) modalities to identify which methods are useful to practitioners, producing technical assistance guidelines for national dissemination. (2) They will collect extensive implementation data as program staff work through the Toolkit’s seven-step process, which will guide the development of a revised final Toolkit. Steps 1 and 2 will be accomplished using online questionnaires, focus groups and interviews. (3) They will compile the prosecution outcome data from the five pilot programs to explore across- and between-site effects regarding the impact of SANE program implementation on criminal justice case outcomes. The researchers will generate site-specific outcome reports, cross-site quantitative analyses, and qualitative findings regarding critical ingredients that contributed to positive (or negative) evaluation findings.

Product: NCJ# 249386

Evaluating the Legal Impact of Sexual Assault Nurse Examiner Programs: An Empirically Validated Toolkit for Practitioners (2014) – Rebecca Campbell, Stephanie M. Townsend, Jessica Shaw, Karim Nidal, Jenifer Markowitz. *Journal of Forensic Nursing.*

This article also provides recommendations regarding program readiness to engage in evaluation activities without compromising program sustainability and patient care. The toolkit can be used by SANE-A and SANE-P programs and their community partners to examine sexual assault prosecution rates in their local jurisdictions. Resources available to practitioners on the nature and use of the toolkit are provided.

Additional NCJ Citations: 249613

2010-NE-BX-K260:	Delivery and Evaluation of Sexual Assault Forensic Examiner (SAFE) Training Programs
Amount:	\$1,424,212
PI:	Debra Patterson
Status:	Completed

This project will create and implement an online didactic Sexual Assault Forensic Examiner (SAFE) curriculum, taught over a 12-week period through a series of modules and followed by a 2-day clinical skills workshop. Each course will be completed in 15 weeks. The course will be offered four times for 75 people in each training wave during the grant. Overall, this project will train 300 SAFEs over the course of 15 months. All modules created for the course will be available to trainees at no cost. A major component to the SAFE training will be related to the identification, collection, preservation and analysis of DNA evidence by medical personnel. This entire project will include (1) an implementation assessment and impact evaluation of the training, (2) technical assistance provided during the training, (3) how this training may impact the sexual assault victim's participation in the criminal justice process, and (4) an

assessment of the utility of the medical forensic documentation by Criminal Justice System (CJS) personnel. This training will be rigorously evaluated by the research team's strategic partners, including Wayne State University, with Dr. Debra Patterson in consult with Dr. Rebecca Campbell. Limited access to education has been identified as a major contributor to the shortage of SAFE-trained clinicians. There is no existing standardized curriculum available for SAFE training, and there is no accreditation process in place for those delivering the training. Even when states have brought in trainers, there has frequently not been the opportunity for clinicians to obtain necessary post-didactic clinical hours. This project will address those issues and others by providing accessible, standardized, evidence-based SAFE training to registered nurses, nurse practitioners, physician assistants and physicians while evaluating the training to determine whether it leads trainees to adopt the necessary skills into their practice and to identify any challenges faced by the trainees in learning and applying these skills. The proposed evaluation will assess the trainees' knowledge, skills, and abilities throughout the training and will examine their skills post-training to document whether they provided empowering patient care (from the patient perspective) and whether the quality of their medical forensic exam documentation (as assessed by national forensic nursing and CJ subject matter experts) is of the caliber required for legal proceedings.

Product: NCJ# 247081

Delivery and Evaluation of Sexual Assault Forensic (SAFE) Training Programs (2014) – D. Patterson, S. Resko, J. Pierce-Weeks, R. Campbell

This study evaluated the effectiveness of the International Association of Forensic Nurses’ Sexual (IAFN) Assault Forensic Examination (SAFE) training programs. The evaluation’s overall assessment is that the IAFN SAFE training curriculum and blended training model provides a strong foundation that can be built upon to meet the diverse learning needs of clinicians across the Nation. The training includes a didactic portion delivered online over a 12-week period and a 2-day simulated clinical skills workshop. Healthcare clinicians from across the Nation were enrolled in the training (n=198). Of these, 79.3 percent completed the training. Students were more likely to complete the training when they enrolled in the program primarily because of the 2-day clinical component. Students who worked in rural communities were more likely to complete the training than students from urban and suburban communities. The mean post-test scores on relevant knowledge were significantly greater than the mean pre-test scores for all 12 online modules. Knowledge gain was positively associated with students who had a reliable Internet connection, students who were drawn to the training because it was free, and those with higher levels of motivation. Lower knowledge gains were significantly related to having more work/personal barriers and those who were drawn to SAFE practice because they or someone close to them had personal experience with sexual assault. Lower knowledge gain was also marginally linked to students who reported less comfort with computers. Students experienced a reduction in knowledge retention from 77.92 percent at post-test to 68.83 percent at the follow-up exam. Qualitative interviews with students suggested that the clinical training helped clarify, broaden, or solidify the content covered in the online modules. Most students reported using many approaches they learned in the training with their post-training patients.

2011-DN-BX-0001:	The Detroit Sexual Assault Kit (SAK) Action Research Project
Amount:	\$1,515,000
PI:	Mary Morrow
Status:	Completed

The mission of the Detroit SAK Action Research Project is to study the problem of untested sexual assault kits (SAKs) in Detroit, MI, to develop pilot response protocols and to implement and evaluate those protocols. In Phase I the grantee will complete an audit of the 10,000+ SAKs in police property in order to have accurate information as to the scope of the problem. The completed audit revealed that there were 11,304 SAKs in the Detroit Police Department property room (through 2009), 8,505 of which had never been submitted to the crime lab. In Phase II, the grantee developed a plan for testing these kits. Leveraging resources from DOJ DNA Backlog Reduction Grants, the NIJ SAK grant, and Marshall University, it was determined that we could test 1,600 kits. Four separate research studies ("waves") were designed to address specific questions regarding the utility of SAK testing in advancing the investigation and prosecution of reported sexual assaults (Wave 1: stranger rape kits, *n* = 450; Wave 3: non-stranger rape kits, *n* = 450; Wave 2: comparing DNA testing methodologies, *n* = 350; Wave 4: presumed statute of limitations-expired kits, *n* = 350). In Phase III of this project, the grantee will complete all SAK testing and associated research analyses. The grantee will also implement and evaluate a multidisciplinary victim notification protocol. Finally, the grantee will complete a longitudinal investigation as to the underlying reasons why Detroit had so many untested SAKs. The final report will also document the processes followed in Detroit in order to develop "transportable lessons" for other communities struggling with the problem of untested SAKs.

Product: NCJ# 248680

Detroit Sexual Assault Kit (SAK) Action Research Project (ARP), Final Report (2015) – Rebecca Campbell, Giannina Fehler-Cabral, Steven J. Pierce, Dhruv B. Sharma, Deborah Bybee, Jessica Shaw, Sheena Horsford, Hannah Feeney

This final report on the Detroit Sexual Assault Kit (SAK) Action Research Project (ARP) addresses the following project goals: to assess the scope of the problem by conducting a complete census of all SAKs in the police property inventory; to identify the underlying factors contributing to so many unsubmitted SAKs; to develop a plan for testing SAKs and to evaluate the efficacy of that plan; and to create a victim notification protocol and evaluate the effectiveness/efficiency of that protocol. First, the study found that there were 11,219 SAKs in police custody as of November 1, 2009. A total of 2,512 SAKs had laboratory ID numbers, indicating that they had been submitted for testing, but it was unclear how many had actually been tested for DNA. The Project developed a step-by-step summary of the census procedures used in the project to assist other jurisdictions in conducting a similar census of SAKs in police custody. Second, the underlying reasons for the large number of untested SAKs pertained to chronic understaffing and resource depletion compared to other U.S. cities of similar size, composition, and crime rates, as well as police personnel victim-blaming attitudes in sexual assault cases, without consistent supervision and training to challenge these attitudes and related practices. Third, the project developed and evaluated a plan for funding the testing of uncommitted SAKs. Funds were pooled from the Detroit SAK ARP budget, the State police department’s NIJ DNA Backlog Reduction Grants, and the resources of a university-based forensic laboratory that was separately funded by NIJ. Under this funding, the project tested 1,600 SAKs. Fourth, the project developed and evaluated a victim notification protocol that provided a structure for processing sexual assault cases accompanied by victim notification of completed processing steps.

2011-DN-BX-0002:	The Houston Sexual Assault Kit (SAK) Action Research Project
Amount:	\$1,514,890
PI:	Irma Rios
Status:	Completed

The goal of the Houston Sexual Assault Kit Action Research Project is to examine the problem of untested sexual assault kits (SAKs) in the Houston Police Department (HPD) property room. Specifically, this two-phase project will help to identify (1) factors inhibiting the number of SAKs forwarded to the HPD Crime Lab for analysis and (2) factors that undermine the effective use of forensic evidence in sexual assault cases. In Phase I of the project, the project team worked with HPD to conduct an audit of the more than 16,000 untested kits in the HPD evidence storage facility and found that there were far fewer untested SAKs than previously estimated. Also in Phase I of this project, the researchers conducted 146 interviews of law enforcement investigators, prosecutors, crime laboratory analysts, sexual assault nurse examiners, victim advocates, and victims. The interviews helped the team develop an in-depth understanding of untested sexual assault evidence in Houston. Phase II goals include (1) completing the research work started in Phase I, to be used to identify a feasible plan to screen, test, and use evidence contained in SAKs that have not been submitted for forensic testing; (2) implementing the strategies finalized in goal 1; and (3) evaluating the implementation and outcomes of the strategies.

Product: NCJ# 249812

Unsubmitted Sexual Assault Kits in Houston, TX: Case Characteristics, Forensic Testing Results, and the Investigation of CODIS Hits, Final Report (2016) – William Wells, Bradley Campbell, Cortney Franklin

Houston’s Action Research Project Working Group, which was established under the grant from the National Institute of Justice (NIJ), was composed of representatives from multiple stakeholder criminal justice and community organizations. The Working Group’s research agenda included not only the identification of factors that produced the SAK backlog but also the way sexual assault forensic evidence is used during investigations and prosecutions of sexual assaults, as well as what stakeholders should expect when large numbers of previously unsubmitted SAKs get tested. Based on its findings, the Working Group offers eight recommendations. First, jurisdictions should collect data and report results on the characteristics of cases with unsubmitted SAKs, the forensic testing results, and investigation outcomes that follow from testing. Second, future research should compare similar groups of cases that differ only in terms of whether or not a SAK was submitted and tested. Third, jurisdictions should prepare for the workload that results when labs begin testing unsubmitted SAKs, some portion of which will involve older sexual assault cases. Fourth, gather baseline information about current practices to identify strengths and weaknesses in current responses to sexual assaults. Fifth, give priority to victim engagement and participation. Sixth, consider the use of a SAK testing

prioritization system even when all unsubmitted SAKs will be tested. Seventh, measure and report the criminal justice system outcomes of sexual assault cases after SAK testing. Eighth, measure a broader set of outcomes in addition to the results of criminal cases.

2011-DN-BX-0003:	The Impact of Forensic Evidence on Arrest and Prosecution
Amount:	\$174,668
PI:	University of New Haven
Status:	Completed

The grantee will conduct a study focused on 8 of the 10 research recommendations made in the Peterson et al. (2010) report. There are two phases of the study. Phase one will analyze a random sample of approximately 2,500 case files from 2006 through 2009 that contain forensic analyses from the Connecticut State Forensic Science Laboratory, along with corresponding police and prosecutorial case files. The goal of the proposed research is to further our understanding of how the presence of forensic evidence relates to case clearance and conviction. As with Peterson et al. (2010), this research has four research objectives: (1) Estimate the percentage of cases in which crime scene evidence is collected; (2) discover what kinds of forensic evidence are being collected; (3) track such evidence through the criminal justice system; and (4) identify which forms of forensic evidence are most efficacious, given the crime investigated. The research instrument to be used in the coding of these case files is a slightly modified version of the instrument used by Peterson et al. This instrument records up to 40 variables in three separate categories: forensic, criminal offense, and crime disposition. The proposed study will also introduce two variables not recorded in the previous study: Did any available witness name a suspect or provide a description to police? Did the suspect make a statement? Phase two will consist of qualitative interviews regarding case files randomly selected from the sample population listed above, with approximately 270 investigative and prosecutorial personnel. These interviews will further advance our understanding of how forensic evidence affects the use of investigative and prosecutorial discretion. These interviews will be centered on four themes: the exact nature of assistance provided by physical evidence in the identification of the offender, the use of forensic evidence in the interview and interrogation process of witnesses and offenders, the utility of forensic evidence in plea negotiations, and the effect of forensic evidence on sentencing. (NCJ product publication in process)

2011-WG-BX-0005:	Forensic Evidence and Criminal Justice Outcomes in a Statewide Sample of Sexual Assault Cases
Amount:	\$97,519
PI:	Theodore Cross
Status:	Completed

This study has three goals: (a) to provide a detailed description of forensic evidence in sexual assault cases, including its timing relative to criminal justice outcomes; (b) to examine the relationship of forensic evidence to criminal justice outcomes; and (c) to analyze the effect of forensic evidence in key segments of the sample: cases with child victims, cases with stranger assailants, and cases with sexual assault nurse examiners (SANEs) conducting the examination. The research objectives include (1) examining the frequency of different types of forensic evidence; (2) assessing the timing of forensic evidence availability vis-à-vis arrests and filing criminal charges; (3) assessing the relationship of forensic evidence to arrests and filing criminal charges; (4) assessing whether the relationship of forensic evidence to outcomes is stronger in cases with child victims and in cases with suspects who are strangers; (5) comparing SANE versus non-SANE medical providers on forensic evidence and on arrests and the filing of criminal charges. The proposed retrospective research will draw a random sample of 436 sexual assault cases reported in the Commonwealth of Massachusetts between 2008 and 2010 from a database of 3,000 documented sexual assault cases with medical examinations maintained by the State's Executive Office of Public Safety and Security (EOPSS). Using unique, anonymous case identifiers, data will be merged from three sources:

(1) Provider Sexual Crime Reports, a mandatory form on assault and victim characteristics filled out by medical providers and stored in the EOPSS database; (2) Non-electronic crime laboratory data, from which data on forensic evidence and injury will be abstracted and put into spreadsheets; and (3) police incident data from the National Incident Based Reporting System (NIBRS) and a Boston Police Department database, which provide information on arrest and the filing of criminal charges as well as victim, offense and assailant characteristics. Descriptive and bivariate statistics will be used to describe the prevalence and timing of different types of forensic evidence in sexual assault cases. Multivariate statistical analyses will also examine the effects of forensic evidence on case outcomes—by age of

victims and by assailant-to-victim interactions—to see if the effect of forensic evidence is stronger for child victims and in cases involving strangers; and examining forensic evidence effects separately in these groups. Logistic regression will also compare SANE and non-SANE cases on forensic evidence and on arrests and the filing of charges to see if any SANES’ impact on outcomes is mediated by the forensic evidence that SANES obtain.

Product: NCJ 248254

Forensic Evidence and Criminal Justice Outcomes in a Statewide Sample of Sexual Assault Cases (2014) -- Theodore P. Cross, Ph.D.; Megan Alderden, Ph.D.; Alexander Wagner, M.A.; Lisa Sampson, MSW; Brittany Peters, M.S.; Meredith Spencer M.A.; Kaitlin Lounsbury, M.A.

Sexual assault is a heinous crime that as many as a quarter of women nationally experience in their lifetime. Not only do victims suffer the terror and degradation of the assault but they are also at risk of further injury and a range of difficulties with mental health and functioning. Survivors are also at risk of re-victimization from informal and professional responses that question their credibility and, in effect, blame them for the assault. In this difficult context, investigative methods that increase evidence against assailants while decreasing the burden on victims are especially important, and advances in the technology and expertise of collecting and analyzing injury and forensic evidence offer promise. The study (1) examines the frequency of injury and biological evidence in sexual assault cases; (2) identifies case factors associated with the presence of injury and biological evidence; (3) analyzes how often biological evidence is processed before versus after arrest; (4) explores how injury and biological evidence as well as other factors are related to arrest; and (5) examines results for key comparisons thought to be salient for forensic evidence: Sexual Assault Nurse Examiners versus other medical examiners, strangers versus known suspects, and child victims versus adults and adolescents. This study merged data from three sources: (1) the Massachusetts Provider Sexual Crime Report (PSCR) database; (2) forensic evidence data abstracted for the study from the two crime laboratories serving the state; and (3) data on findings, arrests and criminal charges from 142 different police agencies across the state.

2013-NE-BX-0004:	Evaluate a Novel Fluorescent Dye to Detect Ano-genital Injury in Women of Color
Amount:	\$253,561
PI:	Kathryn Laughon
Status:	Completed

Racial disparity is a serious problem in the detection of injury during the forensic exam of sexually assaulted patients. Objective documentation of tears and abrasions to the external genitalia after sexual assault is an important part of the forensic exam. Victims with documented injury are more likely to have their cases moved through the criminal justice system, and these cases are more likely to result in a guilty verdict than cases lacking documented injury. Unfortunately, the genital injuries experienced during sexual assault are often small and difficult to visualize on visual exam. The current standard of care is to use a 1% aqueous solution of toluidine blue dye to highlight areas of unhealed trauma on the external genitalia. This technique is highly effective for light-skinned women, but far less so for women of color, resulting in unequal adjudication of cases and rates of conviction. This early stage translational research will lead to identifying a dye that will be effective on all skin colors. We plan to validate (in both mice and humans) a forensics product that deploys fluorescent dye and a widely available excitation/illumination lamp for visualizing tears and abrasion on dark skin. Two specific aims guide this study: Aim #1: Identify a suitable fluorescent dye and validate it in a murine (mouse) skin injury model. Suitable dyes will be non-toxic, adhere to damaged epithelial cells, be easily visualized using equipment already in common use among forensic examiners, and will not interfere with subsequent forensic DNA testing. Aim #2: Evaluate the safety, feasibility and efficacy of the identified fluorescent dye in women. Dyes identified as suitable from the first part of the study will be tested for safety in healthy women using skin on the forearm. The dyes will be applied to non-injured skin to ensure safety. They will then be used on the external genitalia of women within 48 hours after consensual penile-vaginal intercourse to test application procedures, ability to photograph injuries, ability to detect genital tears and abrasions, and safety (local skin irritation, patient reports of pain). These findings will serve to guide a subsequent, larger comparative efficacy trial of the identified dye. The mouse component of the study will use 24 8-week old (adult) mice. For the human component, 50 women of color, aged 18 to 45, will be recruited in an attempt to obtain 34 with sufficiently dark skin for testing.

Product NCJ# 250666

Evaluation of a Novel Fluorescent Dye to Detect Ano-genital Injury in Women of Color (2017) -- Kathryn Laughon

A fluorescent stain would be visible regardless of the surrounding skin color through the use of an alternative light source (ALS). The study findings suggest that fluorescein (FL) is both safe and feasible to use in detecting genital injury in sexual assault victims across all skin tones, including dark skin. A 1% solution of FL visualized under blue light was equally effective as TB in enabling the accurate identification of injuries by blinded observers in the murine (rodent) studies and was effective for visualization of genital injuries in women after consensual intercourse in the human study, although the very small number of injuries precluded drawing a firm conclusion about the efficacy of the dye. FL did not delay wound healing in either the murine or human study. It was not associated with any safety concerns in the human study. Implementation of this technique for injury documentation in the clinical exam room will require, in addition to a single lens reflex camera, the availability of a blue light for illuminating the wound and a yellow filter. Both of these items are widely available for less than \$50, and there is no anticipation that these additional expenses are barriers to the use of FL in the clinical exam for those forensic examiners already using a camera that allows use of a filter.

2014-NE-BX-0006:	Serial Sexual Assaults: A Longitudinal Examination of Offending Patterns Using DNA Evidence
Amount:	\$699,533
PI:	Rebecca Campbell
Status:	Completed

Serial sexual assault is a pervasive problem: Court record recidivism studies show that 10-15% of convicted sex offenders re-assault within five years, and self-report surveys suggest that 60%+ of males who have committed sexual assaults have raped more than one individual. The purpose of the current study is to document the scope of repeat perpetration using DNA evidence in sexual assault kits (SAKs) to find serial rapists. The federal criminal DNA database will be examined using a sample of previously untested SAKs from Detroit, along with rates and patterns of serial sexual assault based on DNA matches in CODIS (Combined DNA Index System). Guided by criminal career theory, serial sexual offenders, longitudinal crime patterns and the extent to which their offending varies with respect to victim-offender relationship (i.e., stranger vs. non-stranger) and victim age (i.e., child vs. adult victims) will be explored. CODIS hits emanating from a sample of N=7,393 previously untested SAKs will be examined and full adult criminal histories for all CODIS-identified offenders will be obtained to model their offending patterns over time. Practitioner partners include the Michigan State Police, who granted research access to the CODIS testing outcomes and criminal histories; and the Michigan Domestic & Sexual Violence Prevention & Treatment Board, which will advise the team on implications for survivors and victim advocacy services. Using a cross-sectional design, the rates and types of serial sexual assault CODIS hits and how those rates vary by victim-offender relationship and age will be documented. A longitudinal design will be used to explore patterns of serial sexual offending, including identifiable patterns within an offender’s own criminal history and similarities between the cumulative criminal histories of different offenders. Variability in the geographic locations of serial sexual offenders’ patterns of crime will also be examined. Continuation-ratio and polytomous logistic regression models will be used to quantify the rates and types of CODIS hits. Latent variable mixture models will be used to identify subgroups with distinct patterns of offending over time. Log-linear models will be applied to transition matrices to explore the geographic mobility of offenders’ crimes over time.

2014-NE-BX-0009:	Post-Coital DNA Recovery in Minority Proxy Couples
Amount:	\$939,398
PI:	Patricia Speck
Status:	Completed

The purpose of the proposed research is to explore, in monogamous racial minority couples, the presence or absence of post-coital DNA at baseline, and 4, 7, and 9 days post-unprotected coitus; and to identify variables that diminish or enhance DNA recovery. More specifically, the research aims to identify the time period in which it is possible to collect post-coital DNA in minority women using Y-STR laboratory methods; and the physiological conditions, factors or activities in minority couples that influence post-coital DNA recovery. It is hypothesized that non-white couples will have similar DNA recovery and influences as that found in the investigators’ prior research of predominantly white couples. The proposed research will use a prospective, repeated measures design with subjects including dyads of non-white minority women and their partners serving as their own controls. A mixed-methods approach will be used. There are four phases to this project: (1) IRB full review for minority proxy couples; (2) recruitment, collection, and laboratory development of samples; (3) evaluation of data from laboratory and

questionnaires; and (4) dissemination of the research. Criminal Justice System Improvement Evaluation of the timing of evidence collection procedures for minority proxy couples does not exist. This research will improve the criminal justice system response to racial minority victims. By validating similar DNA recovery, this research may provide the evidence for policy change for health care and criminal justice response to reporting minority women. The research may advance the decisions made by law enforcement and laboratories to process delayed-reporting cases, thereby providing evidence to support the expansion (or not) of the 72-hour limit for minority woman; evidence found in cases with delayed reporting could enhance prosecution and convictions.

2016-AK-BX-K020:	Evaluation of the Bureau of Justice Assistance Sexual Assault Kit Initiative
Amount:	\$1,999,995
PI:	Suzanne Kaasa
Status:	Open

Sexual assault kits (SAKs) are invaluable tools used in investigations to collect evidence, such as DNA, and to document injuries from alleged victims; this evidence, in turn, is used to identify and prosecute offenders and to exonerate innocent suspects. Despite the importance of SAKs, backlogs of unsubmitted and untested kits have emerged in jurisdictions across the country (e.g., Peterson and Hickman, 2005; Strom et al., 2009). Gaps in SAK processing stem from complex issues, such as the expanded use of DNA testing in sexual assault and other cases, which can require substantial resources beyond the current capacity of jurisdictions (Wilson, 2016). Other issues relate to complications arising from the fact that different types of organizations must coordinate efforts through each stage of SAK processing. The purpose of the proposed project is to assess components of the Bureau of Justice Assistance (BJA) Sexual Assault Kit Initiative (SAKI) to prepare for a subsequent comprehensive evaluation. BJA funded 20 sites in 2015 to engage in reforms intended to improve the national response to sexual assault cases. The goals of this initiative were to (1) create a coordinated community response that ensures just resolution to cases through a victim-centered approach, and (2) build jurisdictions capacity to prevent the development of conditions that lead to high numbers of unsubmitted SAKs. The objectives of the proposed study are to (1) conduct a process evaluation of five advanced SAKI sites that will provide information on what works for newer sites implementing reforms; (2) conduct an evaluability assessment of all 20 sites to determine the readiness to participate in an evaluation of the SAKI, and to develop a comprehensive and rigorous evaluation plan; and (3) conduct an impact assessment to determine the extent to which SAKI reforms have resulted in intended (and/or unintended) system changes. Our study design is a mixed-methods approach, including quantitative analysis of administrative data and qualitative coding and analysis of document reviews, site visit observations, and interviews. Our proposal plans include an efficient data collection and reporting design that allows for timely ongoing feedback to NIJ, BJA, the Training and Technical Assistance (TTA) Provider, grantee sites, and other national stakeholders to apply lessons learned. Findings are expected to result in a comprehensive, rigorous, and full evaluation plan for the SAKI and to positively impact the implementation of SAKI reforms to improve sexual assault investigation practices, victim support services, and collaboration among agencies.

2016-DN-BX-0004:	Characterization of Personal and Condom Lubricants using DART-TOFMS and Comprehensive GC-MS
Amount:	\$150,000
PI:	Candice Bridge
Status:	Ongoing

Due to increased awareness of DNA identification in sexual assaults, and the accuracy of DNA matching, criminals are using condoms to prevent leaving their DNA on the victim. In the absence of DNA, the condom lubricant can be used to link the suspect and the victim. This project focuses on characterizing the residual lubricants after a sexual assault and understanding how their chemical composition changes from the unaltered sample. Lubricant components that remain on the victim’s body or at the crime scene will be identified and can be used to indicate sexual intercourse. In contrast to other studies, both major and minor lubricant components, which are indicative of lubricants versus personal hygiene products, will be the focus. In addition, components that can classify the type of the recovered lubricant will be identified. The first phase will characterize lubricant samples and identify components that are specific to individual lubricant classes. Samples will be characterized on the DART-TOFMS and 2d-GC-MS because they provide superior baseline separation of individual components versus the traditional GC-MS. The goal is to identify classes based on unique peaks corresponding to the major and minor components. (Duration: 5 months)

The second phase will identify the chemical morphology of the lubricant when exposed to common situations. Lubricants will be placed on a skin alternative and analyzed over a 72-hour period to determine the persistence of major/minor components. Samples will also be exposed to different environmental conditions to determine how the lubricant components persist after 5 days. This will be useful to determine how long lubricants will remain on condoms, fabrics, and skin after intercourse. (Duration: 21 months) The recovered lubricants from the environmental and skin persistence studies will be compared to the unchanged lubricants to determine the significance of the chemical degradation, using PCA. Bayesian networks and likelihood ratios will be used to ensure that the classification schematic developed will accurately place the recovered lubricants in the same class as the unchanged lubricant. (Duration: 6 months) The graduate student will lead the characterization, classification, and degradation of the lubricants as well as produce publications, presentations, and a dissertation presenting the findings of each milestone. Generated data sets will be archived as .csv files at NACJD and on NCFS website for interested researchers. This classification scheme will lay the foundation for a protocol that forensic analysts can use in the evaluation of trace evidence in sexual assault crimes.

2016-DN-BX-0005:	Characterization and Quantification of Microbial Degradation of Sexual Lubricants
Amount:	\$150,000
PI:	Candice Bridge
Status:	Ongoing

As DNA analysis is accepted as the gold standard for identification purposes, condom usage with sexual assaults has increased. The lubricant from the condom can remain at the crime scene or on the victim and provide a link to the suspect. In an ideal setting, samples from sexual assault kits will arrive at the lab in a pristine condition. If evidence is improperly packaged for shipping, then microbial degradation can occur. During a sexual assault, the condom will be exposed to multiple bacterial strains that populate the female genitalia, including the *Lactobacillus* and *Megasphaera* species. When exposed to the female microbiome, lubricants can degrade, which hinders the identification of residual lubricants, thus severing the link between suspect, sexual assault, and victim. The purpose of this project is to identify the major degradation components of residual lubricants and to characterize the overall change in the chemical composition. The first phase exposes lubricant standards to laboratory-grown microbes to determine normal degradation trends. Samples will be analyzed on the DART-TOFMS and GC-MS to compare the accuracy of lubricant identification between degraded and non-degraded samples, thus generating analytical methods for both instruments. (Duration: 8 months) Phase 2 will evaluate the degradation of 45 condom samples from laboratory-grown microbes to identify the change in the overall chemical composition from the unaltered lubricant. Additionally, the degraded samples will be compared to the initial degradation trends observed in Phase 1. (Duration: 9 months) The third phase will require collecting vaginal mucus from 20 female volunteers to identify the human microbiome. Personal identifiers will not be collected; however, descriptors such as age, race, recent sexual activity, and the vaginal microbiome history will be collected. The lubricant standards and condoms will be exposed to the human samples to determine degradation of the lubricants. (Duration: 15 months) Bayesian networks and likelihood ratios will be applied to the degradation data to identify degradation trends and determine if degraded samples can be matched to the non-degraded lubricant. The graduate student will lead the characterization and microbial degradation of the lubricants as well as produce publications, presentations, and a dissertation presenting the findings of each milestone. Generated data sets will be archived as .csv files at NACJD and on NCFS website for interested researchers. This analytical method to compare microbial degraded samples with non-degraded lubricants will provide forensic analysts more information that can be exploited from traditional forensic samples.

2016-DN-BX-0001:	Development and Evaluation of miRNA Panels for Body Fluid Identification Using Capillary Electrophoresis and Massively Parallel Sequencing Methods
Amount:	\$147,161
PI:	Carrie Mayes
Status:	Ongoing

The ability to determine the body fluid of origin may be relevant to the course of forensic investigations, particularly in sexual assault cases. Although DNA typing can identify the individual who deposited a stain, current methods cannot conclusively determine whether the sample was due to saliva, vaginal material, semen, or venous or menstrual blood. This determination may be critical in the reconstruction of events. This project will provide information regarding the utility of micro RNA (miRNA) analysis for body fluid identification (BFID) by evaluating the stability and persistence of miRNAs in forensically relevant samples. In addition, this study will provide crime laboratories

with the ability to distinguish venous blood, menstrual blood, semen, vaginal material, and saliva using current capillary electrophoresis (CE)-based methods already employed in crime laboratories, or with a novel STR/BFID panel via massive parallel sequencing (MPS) technologies. The DNA/RNA co-extraction method allows for the co-analysis of DNA and BFID from a single sample, providing more information from each limited sample. This study will be divided into 3 phases and conducted over 36 months: (1) Develop a 10-marker multiplex miRNA system for the identification of venous blood, menstrual blood, semen, vaginal material, and saliva using CE methods; (2) develop a miRNA panel for combined STR/BFID analysis using MPS technologies; and (3) evaluate the stability and persistence of both miRNA systems in forensically challenging conditions. Conditions will include a refrigerated environment, outdoors with and without protection from the rain, buried in soil, clothing on a decomposing cadaver, and in a temperature- and humidity-controlled environment. Expected scholarly products will include a doctoral dissertation, at least two publications in high-impact factor journals, and presentations of data at national scientific meetings.

2017-DN-BX-0199:	Increasing the Efficiency of Sexual Assault Kit Analysis to Enhance the Capacity of Forensic Science in Ventura County
Amount:	\$62,457
PI:	Nivanjit Gill
Status:	Ongoing

The County of Ventura will use this funding to enhance capacity, decrease the turnaround time, and increase the efficiency of the screening of orifice swabs from sexual assault kits in cases where the victim is female and the perpetrator is male. This is accomplished by implementation and validation of a process efficiency project that replaces time-consuming serological screening with a quick and automated examination for male DNA. The funds will be used to support the validation by providing overtime pay to complete the validation and purchase analysis kits to be used in the validation.

2017-DN-BX-0184:	Forensic DNA Laboratory Efficiency Improvement and Capacity Enhancement Program
Amount:	\$750,000
PI:	Guy M. Vallaro
Status:	Ongoing

The Department of Emergency Services and Public Protection will use this funding to replace the traditional serological screening of sexual assault cases with a DNA screening method that directly detects Y-chromosomal DNA. Process mapping of the current and proposed methods for processing sexual assault cases indicates that the adoption of Y-screening will reduce the time to screen a sexual assault case by about 1.75 hours per kit. The project will hire and train a grant-funded Forensic Examiner, validate the testing of the Y-screening technique, and implement new operating procedures and testing.

2017-IJ-CX-0003:	Capillary Zone Electrophoresis Automated Fraction Collection for the Forensic Analysis of Sexual Assault Evidence
Amount:	\$90,780
PI:	Sarah N. Lum
Status:	Ongoing

The national backlog in sexual assault cases is estimated to be between 100,000 and a half-million untested rape kits. Current methods of analysis are time and labor intensive, requiring overnight procedures and delivering a success rate lower than 40%. The primary challenge crime labs face in analyzing these cases is the separation of purified male DNA from the mixture of primarily female DNA from gynecological swabs. Effective elution of the sample from the swab, and efficient separation of intact sperm cells from epithelial and other cellular debris, allow for a successful polymerase chain reaction amplification and short tandem repeat (STR) analysis of the perpetrator's DNA. Capillary zone electrophoresis (CZE) is a promising tool to perform the cell separation and has three major advantages over alternative technologies: only a small amount of sample is consumed, which allows for replicate analyses of limited available evidence; separation time is rapid compared to standard methods; and single cells can be detected and collected when interfaced with an automated fraction collector that the researcher has helped to develop. Preliminary

results have shown the migration of sperm cells in a confined band in less than 15 minutes. In addition, CZE instruments are presently used in the majority of crime laboratories for DNA analysis, so analysts will already have the necessarily training to operate this CZE-based technology. The study will be divided into three phases and conducted over 36 months: (1) Develop a CZE system utilizing laser detection to determine and optimize the migration time of sperm in post-coital samples (collected by Dr. Ashley Hall, University of Illinois at Chicago). (2) Develop CZE-Fraction Collection parameters to separate and collect purified sperm cells. (3) Analyze STR profiles of samples of various conditions and tested up to one year following collection. Conditions will imitate storage of current rape kits at room temperature, 4°C, and -20°C. This work will result in a patentable technology that can be implemented in crime labs in the U.S., a doctoral dissertation, at least two publications in high-impact journals, and presentations of results at national and international scientific meetings.

2017-R2-CX-0005:	Identification and Detection of Cosmetics Transferred during Close Personal Attacks
Amount:	\$100,000
PI:	Candice Bridge
Status:	Ongoing

Close personal assaults are a common occurrence, and many perpetrators are aware of the potential transfer of DNA and will try to limit the transfer accordingly. However, many are not aware of the transfer and identification power of cosmetic components such as shimmer and glitter. This project focuses on understanding the individualization power of glitter and shimmer components by identifying unique features in order to compare cosmetic particles. This project focuses on determining the transfer potential between two people or between a person and a scene. In contrast to other studies, this project will focus on analyzing microscopic physical and chemical features that are unique to a sub-class. Additionally, because shimmer is composed of naturally occurring mica, geolocation will be evaluated to attempt to determine where the mica was mined, another layer of individualization. The first phase will characterize shimmer and glitter components and identify features unique to one sub-class. Because of their organic nature, shimmer samples will be characterized via PLM, FTIR, and XRD to determine each crystal's structure and physical properties. DART-TOFMS and SEM-EDS will be used to analyze the composition of the shimmer's coating. The metallic glitter particles will be analyzed by SEM-EDS and the polymeric samples analyzed by FTIR. The most unique features for discrimination will be determined using PCA and LDA, providing the foundation for classifying real samples. (Duration: 19 months) The second phase will focus on the primary transfer of these components between people and a scene. Effects of the environment on glitter and shimmer will be evaluated to ensure that the physical and chemical compositions do not change over time. This will determine how long shimmer and glitter particles will remain on the assailant, or at the scene after an attack. (Duration: 9 months) The third phase will focus on the characterization of real samples. Cosmetic particles will be isolated from the sample matrix for analysis, thus providing an understanding of how similar or different the manufacturing brands are in physical and chemical composition, or if several components are used by one manufacturer. (Duration: 7 months) The graduate student will lead the analysis at each phase as well as produce publications, presentations, and a dissertation on the findings. Data sets will be archived as .csv files at NACJD and the NCFS website for interested researchers. This classification scheme will lay the foundation for the evaluation of cosmetic evidence in close personal assaults.

2017-R2-CX-0006:	Identification and Analysis of Body Fluid Traces Using ATR FT-IR Spectroscopy
Amount:	\$99,986
PI:	Ewelina Mistek
Status:	Ongoing

Biological samples are an extremely important element in a crime scene. They are the only type of evidence that can provide information about a direct donor. Most of the presumptive tests, which specify whether or not a stain is a biological trace, require chemical treatment and therefore are destructive to the sample. Thus, a method that is nondestructive to the stain is desirable; it could eliminate non-informative traces and allow a focus on the most valuable pieces of evidence. Tests confirming blood of human origin are mostly destructive to the sample and require laboratory settings. The ultimate goal of the proposed research project is to develop a new method for nondestructive, inexpensive, rapid, and on-scene detection, identification, and characterization of body fluid traces in a forensic context. An attenuated total reflection (ATR) Fourier transform-infrared (FT-IR) spectroscopy was already found to be easy to use, nondestructive to the sample, requiring no to minimum sample preparation, and as highly selective as any vibrational spectroscopic methods. Moreover, portable instruments are commercially available to perform all analysis on-field. The (bio)chemical composition of different body fluids was found to vary; moreover, the

composition of blood was proven to have quantitative changes within the same components between different species and different human donors. This study will include development of spectroscopic library and statistical models for identification of dry traces of five main body fluids, development and validation of statistical models for differentiating human and animal blood, and development of spectroscopic library and statistical models for determining a donor’s sex and race, based on a dry bloodstain. All samples will be chosen with gender, race, and age diversity for all aims regarding the human donors. Different breeds with mixed-gender samples will be used to discriminate between human and animal blood samples. After spectra are collected using FT-IR spectroscopy, they will be loaded into statistical software for pre-processing and modeling for discrimination purposes. To strengthen the reliability and validity of the analysis, validation tests will be performed using internal and external operations of predictions, with new and/or unknown body fluid samples.

2017-DY-BX-0004: SADO’s Post-conviction DNA Testing Project
Amount: \$506,394
PI: Dawn Van Hoek
Status: Ongoing

Michigan's State Appellate Defender Office (SADO) will continue reviewing felony cases in which post-conviction testing may be warranted. The proposed work in 2017-2019 will come from three sources: (a) approximately 371 of the original Detroit Police Department (DPD) cases that remain open; (b) 555 recently discovered, untested DPD kits; and (c) at least 3,000 untested sexual assault evidence kits that have been discovered in other Michigan counties, with more anticipated.

2017-AK-BX-0012: New York State Department of Corrections and Community Supervision FY 2017 Sexual Assault Forensic Evidence-Inventory Tracking and Reporting Project
Amount: \$483,666
PI: Stephen J. Maher
Status: Ongoing

New York State Department of Corrections and Community Supervision (NYSDOCCS) acknowledges the urgency to inventory and track all forensic biological evidence and sexual assault kits (SAKs) in its possession to ensure prompt analyses and tracking to support prosecution, where the perpetrator is known and the evidence warrants. DOCCS employs approximately 19,000 correctional officers of various ranks, 900 community supervision officers, and 185 Office of Special Investigations (OSI) investigators. In New York State, all of these personnel have peace officer status. One of the functions of DOCCS OSI is to investigate all allegations of sexual abuse and assault, whether allegedly perpetrated by inmates or staff. Within OSI is a 24-person Sex Crimes Division Unit (SCD) responsible for these investigations. As of this writing, SCD is investigating and tracking 1,934 sex crime-related allegations, but not all cases have or will result in a SAK. With correctional facilities located throughout New York State, OSI investigators in general, and the dedicated SCD investigators in particular, need to gather forensic biological and physical evidence from multiple locations and must maintain strict chain-of-custody possession of such materials. Currently, the tracking of sex crime evidence, including the biological SAKs, is managed through manual entry into physical log books. This obviously is a cumbersome process and results in the lack of a centralized, automated account of evidence content and location, to say nothing of tracking cases through the departmental and greater criminal justice process. As such, DOCCS desires and needs to obtain an automated evidence/investigative management system. DOCCS commits to the implementation and completion of three tasks: the inventory of all existing SAKs in the department’s custody, and the filing of the required certification; the tracking of SAKs through disposition for a minimum of 12 months; and, finally, the reporting and posting of required metrics to NIJ and on the department’s website. To achieve all three tasks in the 36-month award period, DOCCS will purchase, through a competitive bid process, an automated and technologically sophisticated evidence and investigative management tracking system. Concurrent with the acquisition of the tracking system, DOCCS will hire and train a full-time evidence control custodian. DOCCS will adhere to all NIJ and OJP reporting requirements, including all quarterly and semi-annual progress reports. Once the initial inventory is complete, DOCCS will track the progress of all SAKs in its possession and, every 60-days, will post required metrics on its website. Since DOCCS already maintains a public website, it will develop a template and location for the report. The metric report will adhere to the following format: the full operational name of DOCCS, the period covered in the report, and the total number of SAKs in DOCCS’ possession.

2017-AK-BX-0011: SAFE Evidence Tracker

Amount:	\$6,130
PI:	Gerald R. Minchin III
Status:	Ongoing

The Lake Mary Police Department’s current evidence-tracking system is not sufficient to allow the department to inventory, track, and report untested and unsubmitted sexual assault kits (SAKs). The current system has reached its life cycle replacement period, and the program was not specifically developed to track evidence in a law enforcement domain. It helps businesses manage financials, supply chain, and production planning. The system has been experiencing system failures and has been producing false data, causing our evidence specialist to manually inventory and physically search for pieces of evidence. Over the years, the Lake Mary Police Department has seen an increase in incoming evidence. In 2015, the Department received 2,610 pieces of evidence. Since 2015, the agency has received 3,181 pieces – a 22% increase – making the incoming evidence total of 11,896 pieces of evidence and approximately 0.15 percent of those pieces of evidence are high-liability items (1,786 total). SAKs make up 0.1 percent of total evidence received. Two out of nine SAKs were never submitted for testing. The department has one evidence custodian responsible for the receipt, transport, and manual inventory/purging of property/evidence. In addition to property/evidence duties, the evidence custodian is responsible for State Attorney’s requests, body camera video/dash camera video requests, and research of dispositions of cases, taking up to three or four hours of her time.

2017-AK-BX-0008:	Pasco Sheriff's Evidence Tracking Automation
Amount:	\$238,608
PI:	Haria Haught
Status:	Ongoing

Pasco County occupies 868 square miles of land and is home to nearly 500,000 residents, making it the 12th most populated county and 6th largest unincorporated jurisdiction in Florida. When compared to all local (city and county) law enforcement agencies in Florida, Pasco Sheriff's Office (PSO) serves as the seventh largest population of any local law enforcement agency in Florida. Pasco County is centrally located on Florida's west coast, about 30 miles north of Tampa and 50 miles west of Orlando. As a result, Pasco County experiences many of the same problems with crime as those large metropolitan jurisdictions; however, unfortunately it does not have the same tax base as those jurisdictions, which adversely affects the funding of governmental agencies within the county to include PSO. Our annual budget is not as robust when compared to counties of similar size, which has forced the agency to streamline its operation and continuously look for ways to increase efficiency, enhance processes, and find alternative methods of funding for important projects to help achieve these goals. To successfully fulfill the identified gap in the tracking and reporting of sexual assault kits (SAKs), PSO is requesting consideration to be awarded the funding needed through the SAFE-ITR program. These funds will afford PSO the ability to contract with a qualified vendor to develop software for a secured automated tracking system to ensure that we meet the standards set by the State of Florida Attorney General Adult and Child Sexual Assault Protocols, the Florida Department Law Enforcement (FDLE) laboratory submission guidelines, and the following Florida statutes: 794.024, 925.11, and the newly created 943.326 (July 1, 2016). Through the acquisition and utilization of funds from this grant, it is the goal of PSO to partner with other law enforcement agencies and the FDLE-Tampa office to establish a strategic plan aimed at improving the quality and coordination of all SAKs submitted. This tracking would begin from the moment the kits are collected and up until their final disposition. The new system would also aid in our initiative, as it would serve as the main tracking tool providing accountability for each item of evidence in our inventory, documenting the chain of custody every step of the way. The SAFE-ITR program furthers our mission in seeking just penalties for those determined guilty by ensuring fair and impartial efforts as justice is being sought for each and every victim.

2017-AK-BX-0132:	Gautier Police Department SAK Inventory, Tracking, and Reporting
Amount:	\$21,478
PI:	Nickolas Crocker
Status:	Ongoing

The City of Gautier Police Department has 40 sworn officers and serves more than 18,500 residents and a heavy load of day visitors/student commuters within its 32 square miles. The young city (incorporated in 1986) has faced natural disaster and economic hardship, and it struggles to find funding for needed equipment. Often, the department must make do with outdated technology or manual methods of record keeping. The department currently has no sexual assault kit (SAK) evidence-tracking system, or even a formal and functional inventory system. Each piece of evidence

is accepted and tracked manually, with only the help of a general incident-reporting software that is not intended to be used for inventory. There is a crucial need for the integration of a software-based SAK tracking system with barcode printing and scanning technology. A new system, complete with a new computer system that is compatible with the software, will allow the small city to better maintain the chain-of-custody on all SAKs and allow the department to better serve victims when responding to, investigating, and prosecuting sexual assault. Those are the two main goals of this project. The requested equipment would create an inventory and tracking system through which older cold-case SAKs, current SAKs, and future SAKs will be input, coded, and tracked appropriately. It would help eliminate the possibility of human error when checking in and checking out the SAK evidence. The data gathered by a SAK tracking system will also allow the evidence technician to easily report SAK numbers to the granting agency and to the general public through the city's newly redesigned and user-friendly website. The resulting electronic inventory, expected to be complete within six months, would also be easily searchable, which is a major asset because the current system is not searchable by a specific piece of evidence or type of evidence.

2017-MU-BX-0133:	Tracking Sexual Assault Kits in Iowa
Amount:	\$796,985
PI:	Janelle Melohn
Status:	Ongoing

The Crime Victim Assistance Division (CVAD) of the Iowa Department of Justice maintains responsibility for paying the costs of forensic sexual assault exams conducted in the state. CVAD is additionally the agency that pays for the manufacture of sexual assault kits (SAKs) used in Iowa. SAKs are distributed to medical providers by the Department of Criminal Investigations Criminalistics Laboratory (DCI). SAKs with evidence collected are eventually analyzed by the DCI as well. Annually, 1,000-1,500 SAKs are distributed for use statewide. However, SAKs are not currently tracked from the point of distribution to use in a forensic exam, into law enforcement's possession, and when submitted for analysis. The Iowa Department of Justice is a recipient of Bureau of Justice Assistance Sexual Assault Kit Initiative (SAKI) funding. A statewide inventory, showing 4,265 untested SAKs, was completed in November 2016. CVAD is the project lead, and the DCI is key partner in the multidisciplinary team (MDT). In addition to testing SAKs through the SAKI project, one of MDT's goals is to implement systemic changes that will prevent untested SAKs in the future. The goal of the project under this solicitation is to obtain a web-based SAK tracking system, and to implement it statewide to track movement and possession of SAKs, from distribution by the DCI to medical facilities, to law enforcement agencies, and back to the DCI for analysis. Funds from this project will support the additional cost to the current SAK manufacturer to add bar codes to each SAK carton and corresponding victim information and consent form. The bar codes will allow for quick and consistent data entry to track SAKs as they move. As of this application, Iowa has nearly 400 active law enforcement agencies. However, the majority of SAKs inventoried are in possession of departments serving the six largest communities in the state. As a statewide initiative, we plan to implement the tracking system, starting with law enforcement and medical providers in these communities, and roll it out to smaller communities over the course of the project. CVAD operates a robust and comprehensive website that will be utilized for project-reporting requirements. As the SAKI MDT considers policy recommendations to address the systemic issue of untested SAKs, a statewide tracking system is a crucial piece for accountability and for victim-centered handling of SAKs and sexual assault cases.

2017-AK-BX-0010:	Sexual Assault and Forensic Evidence Program
Amount:	\$58,771
PI:	Brian Kramer
Status:	Ongoing

The Highlands County Sheriff's Office (HCSO) provides law enforcement services in a rural portion of south Florida serving over 1,100 acres and approximately 100,000 people. Budgetary restraints and limited financial resources have made it difficult to effectively inventory and track sexual assault kits (SAKs). The goal and objective of this program is to obtain and implement the technology to accurately and efficiently perform a comprehensive inventory of existing SAKs. In addition to implementing the technology to perform the inventory, the technology will enable the agency to establish and maintain accountability of the existing and newly obtained SAKs. Currently, the agency does not have any technology to perform the tasks required in an efficient and effective manner, so they must rely on manual processes, which are antiquated and very labor intensive. Technology exists which will automate the intake of SAKs. The technology will eliminate the manual processing of SAKs and provide a web-based platform that will track the SAKs from initial collection throughout the process including – but not limited to – sending to the lab, returning from

the lab, status reporting, and case identification. The tools and additional features from the implementation of the technology will enable the agency to be more responsive to prosecutors and victims and to provide state-of-the-art chain-of-custody security, which should improve prosecution outcomes. The Highlands County Sheriff's Office expects to use the technology to improve the function of evidence processing, not just for SAKs, but also for the evidence unit as a whole. The agency expects to implement the technology promptly and to provide periodic reporting of progress. In summary, implementation of the proposed evidence-processing technology will dramatically improve the capability and accountability for all evidence in the custody and control of the Highlands County Sheriff's Office. Implementation of the project will allow the Sheriff's Office to provide regular and accurate reporting to the DOJ as required under this project, and to improve the value of DNA evidence obtained from the lab due to better evidence-processing functionality. All of these benefits will be obtained without increasing labor costs to the agency.

2017-AK-BX-0013:	City of Miami Police FY 2017 SAFE-ITR Inventory, Tracking and Reporting Project
Amount:	\$264,263
PI:	Rodolfo Llanes
Status:	Ongoing

With over 440,000 residents in the city of Miami, the Miami Police Department (MPD) oversees the safety of the largest municipality in Miami-Dade County and the second largest city in the state of Florida. In 2015, in cooperation with the Florida Sheriffs Association and the Florida Police Chiefs Association, the Florida Department of Law Enforcement (FDLE) developed and launched a survey of Florida's sheriff and police agencies to determine the number of unsubmitted sexual assault kits (SAKs). The assessment of unsubmitted sexual assault kits revealed there were over 13,435 unsubmitted SAKs throughout the state of Florida, and approximately 9,484 of them should be submitted. The report found that the City of Miami Police Department accounted for 2,243 of the unsubmitted SAKs, by far the highest number for any single law enforcement agency in the assessment. Currently, MPD uses an outdated, 12-year-old database system for the management of SAKs. Lack of query capabilities, real-time tracking information, and a system reliant on manual chain-of-custody lead to incorrect data and delays in the processing of SAKs. Our current WinAce system restricts the ways in which we can categorize, catalog, and identify SAKs. An updated Automated Information Technology (AIT) system would give MPD the ability to have an accurate inventory database that follows the progression of SAKs from submission to disposition with an unalterable, electronic chain-of-custody trail. This enhancement will significantly improve the accuracy and accountability over the current SAKs management process. This project will support FDLE's plan to reduce the statewide backlog. Therefore, the City of Miami Police Department is requesting \$264,263 to improve the processes for the following: Task 1-Inventory, Task 2-Tracking, and Task 3-Reporting. The grant monies will fund the following items: (1) Acquire an advanced AIT system to include installation, data transfer, and training on the new system; (2) overtime to form an evidence overtime team of Property and Evidence Unit personnel to work on tasks 1, 2, and 3 throughout the life of the grant; and (3) train MPD sworn personnel on the new AIT system.

2017-NE-BX-0004:	A Confirmatory Test for Sperm in Sexual Assault Samples using a Microfluidic-Integrated Cell Phone Imaging System
Amount:	\$369,224
PI:	Utkan Demirci
Status:	Ongoing

Rapid and efficient processing of sexual assault evidence will accelerate forensic investigation and decrease casework backlogs. Therefore, the standardized protocols currently used in forensic laboratories will need continued innovation to handle the increasing number and complexity of samples being submitted to forensic labs. To our knowledge, there is no currently available, rapid, and portable forensic screening technology based on a confirmatory test for sperm to identify the most probative samples in a sexual assault kit. For this project, the researchers propose to develop a novel sample screening tool – a microchip integrated with an innovative cell phone imaging platform that records, processes images, and transfers data to a virtual machine for further investigation and storage. The microchip, integrated with a cell phone-based imaging platform, will (i) precisely and rapidly screen forensic samples (<10 minutes after sample preparation on-chip); (ii) provide a direct sperm identification in the mixed-cell population by eliminating the other cell types out of the channel, prior to imaging; (iii) differentiate sperm cells from other cells and cellular debris, especially epithelial cells; (iv) process multiple samples at one time on the same microchip with multiple channels; (v) compute imaging on a cell phone-based application, and transfer the data to a secured virtual machine/cloud

platform; (vi) selectively capture sperm from sexual assault samples; (vii) be sensitive within a forensic cut-off (with $\pm 10\%$ error range); (viii) provide a cost-effective and timely solution to a problem which, in the past, has taken a great deal of time; and (ix) handle small volumes of sample (5-10 microliters). To fulfill this goal, the researchers will first develop a portable, cell phone-based system and an embedded mobile application for screening forensic samples, and will fabricate microchips with multiple channels to process multiple samples at one time on the same device (Aim 1). The researchers will then integrate the cell phone imaging platform and mobile application with disposable microchips as a direct confirmatory test to screen and differentiate sperm from other cell types in forensic samples. The researchers will evaluate the integrated platform with a statistically relevant number of mock sexual assault samples through their collaboration with the Broward Sheriff's Office Forensic Laboratory (Aim 2). The researchers will conduct a validation study of their microchip, integrated with a cell phone imaging system, and correlate with currently used methods used in the forensic laboratories. Through their commercial partner (DxNow), the researchers aim to commercialize a next-generation system to accelerate the sample-screening process for forensic investigations (Aim 3).

2017-NE-BX-0003:	Bioinformatic Analysis of Big Proteomic Data: A New Forensic Tool to Identify Menstrual Blood & Body Fluid Mixtures
Amount:	\$667,774
PI:	Donald Siegel
Status:	Ongoing

The ability to identify menstrual blood has important implications in the criminal justice system in cases where blood stains at a crime scene may be ascribed to a female victim's period, or where a violent sexual assault with vaginal trauma may be claimed as consensual intercourse with a woman during menses. However, the ability to distinguish menstrual from circulating blood poses distinct problems for forensic scientists. Compared to the more commonly tested forensic body fluids – blood, saliva, and semen – which have easily identifiable and abundant marker proteins due to the biological functions these proteins perform in their respective body fluids, menstrual blood is a mixture of the uterine endometrium, vaginal fluid, and mostly blood. Consequently, menstrual blood is similar to a body fluid mixture with all the attendant difficulties of discerning small amounts of unique or enriched markers in a field of other body fluid-abundant markers – and where markers are sometimes shared. Making things even more difficult is that menses is a bodily function that changes during the days of a woman's period, so it is vital that any final test can identify menstrual blood at all times. In their previous NIJ grant, the researchers employed mass spectrometry to evaluate the menstrual blood proteomes of 45 women during all days of menses. The researchers generated extremely large proteomic data sets to search for menstrual blood markers, and they were able to identify five unique menstrual blood markers (but not found at all times) as well as four additional menstrual blood markers, found at all times but shared with a small number of other body fluids. However, with the use of bio-informatic computational analysis on all proteins detected in menstrual and venous blood, the researchers demonstrated that the proteomes of these two body fluids segregated into two groups — effectively distinguishing menstrual and venous blood. The goal of this project is to use Q-TOF mass spectrometry with menstrual and venous bloods from 100 new volunteers to generate large menstrual and venous blood proteomic databases on which the researchers will employ computational bio-informatic approaches to generate a predictive model for menstrual blood identification. This project has three specific aims: (i) to collect and analyze menstrual and venous blood samples from 100 women by Q-TOF MS; (ii) to establish a predictive model; and (iii) to determine the model's limit of detection with menstrual blood, and to evaluate it on other body fluid mixtures to demonstrate its accuracy.

2017-DN-BX-0186:	Nanoscale Imaging and Chemical Analysis of Extracellular DNA in Trace Evidence Samples
Amount:	\$311,609
PI:	Vamsi Yadavalli & Christopher Ehrhardt
Status:	Ongoing

Humans shed tens of thousands of skin cells each day, and these cells are transferred to every surface our skin comes in contact with. At crime scenes, "touch DNA" refers to the DNA that is left behind from skin cells when a perpetrator touches or comes into contact with an item, including physical interaction between two individuals. Analysis of this trace cellular evidence has become an integral part of a forensic laboratory's workload, and an important tool for investigators. However, the relationship between the genetic profile from a touched object and the transferred DNA of cells in the layers of epidermal cells has not been fully elucidated. In fact, there are no conclusive ways even to

identify the kind of epithelial cell itself (skin, vaginal, buccal, etc.). To optimize the recovery and profiling of trace DNA from a scarce sample, it is therefore critical to improve our understanding of the source (epithelial cells) and nature of DNA (whether it is free or anchored to the surface) transferred through touch or contact. Often, investigators have to work only with a few recovered cells, underscoring the need for new kinds of ultra-sensitive tools that can also be rapid and reliable. The objective of this project is to advance the fundamental science of understanding epithelial cell surfaces for forensic analysis. Using nanoscale and traditional analytical tools, the researchers propose to probe cells based on the hypothesis that the outer surfaces of epithelial cells holds the key to answering fundamental forensic questions. These include the differences between various cells as well as the spatial and biochemical context of DNA on the cell surface. Using high-resolution, nondestructive tools, the researchers will be able to gain a unique look at the cell surface – its morphology, its mechanical properties, and the presence of specific cell surface signatures, including extracellular DNA. These spatial and temporal signatures will lead to a better understanding and handling of cellular samples collected as evidence, provide guidelines on storage, and develop ultra-sensitive tools for cell attribution and precise analysis of touch and contact DNA.

2017-NE-BX-0008:	A Low-Cost Isothermal Amplification Microdevice for Rapid Colorimetric Detection Applied to Body Fluid Identification and Y-screening
Amount:	\$387,106
PI:	James P. Landers
Status:	Ongoing

There is no question that PCR has dominated the DNA amplification landscape as a result of the specificity inherent to thermocycling and the ability for rapid generation of billions of copies of an amplicon of a specific size. Isothermal amplification (LAMP) has lurked in the background for two decades and, despite the allure of dodging thermocycling and heat denaturation, it has not been widely adopted. This is likely because more primers are needed, and the generated amplicons cover a broad range of sizes. However, LAMP is ideal for qualitative assays because it is highly specific, generates more amplicon DNA than PCR, and can be read out colorimetrically; hence, the researchers propose that it be applied to body fluid identification (BFID) and Y-screening. With BFID, accurate presumptive/confirmatory tests are essential for gaining contextual information for crime scene investigators; yet, reliable assays are scarce. False positive results are not uncommon with biochemical-based tests that lack specificity, and many methods are known to be destructive to the sample and/or inhibit downstream processes. This has prompted a paradigm shift to nucleic acid testing for screening body fluids and for Y-screening. The latter is equally important because a positive screen for the presence of a body fluid is not always informative for the downstream DNA analysis. Y-screening is currently performed with real-time PCR assays, requiring costly instrumentation; and rt-PCR requires the use of known DNA to create a standard curve for each plate. For the purposes of Y-screening, there is value in detecting a minimum threshold of male DNA; it is here that LAMP is ideal. We propose LAMP for rapid Y-screen and BFID – including venous and menstrual blood, semen, saliva, and vaginal fluid – using colorimetric response and smartphone detection. The method could offer an inexpensive alternative to screening samples and can be easily implemented in forensic casework. We show evidence that LAMP is superior to current presumptive/confirmatory testing because (1) mRNA is targeted with high tissue specificity because of multiple primer sets; (2) proof-of-principle testing successfully identified blood, semen, and saliva, thus setting the stage for expanding the range of body fluids that can be tested; (3) the method is simple and will minimally disrupt forensic lab procedures; and (4) the nature of LAMP reduces the instrument complexity that we will need to build. Add to this, a 96-well format and colorimetric detection that provides a yes/no read-out for six body fluids, using a smartphone.

2017-NE-BX-0007:	A Highly Sensitive Magnetic Nanoparticle Based Method for Reliable and Efficient Screening of Forensic Evidence Samples
Amount:	\$350,656
PI:	Sudhir K. Sinha
Status:	Ongoing

The aim of the proposed project is to address the problem concerning the significant backlog of biological evidence, including sexual assault kits (SAKs), present in local and state crime laboratories throughout the United States. Upon completion of this project, a sensitive, non-PCR-based, nondestructive assay for detection and quantifying total male and human DNA, will have been developed. The method is based on probe hybridization and enzymatic signal enhancement; hence, the assay will be a nondestructive approach to evidence quantification. This can be of great value for low-level DNA evidence sample processing, such as DNA swabs from gun casing and single fingerprint evidence.

By utilizing a low-cost, non-PCR-based assay that can rapidly screen biological evidence, crime scene investigation (CSI) units and crime laboratories can significantly reduce backlogs and focus on probative results in order to solve violent crimes. InnoGenomics proposes to develop a non-PCR hybridization-based method using functionalized nanoparticles, perform simple conjugations, and target DNA using fluorometric techniques. Features of functional magnetic nanoparticles (MNPs) include stability in solution and homogeneous dispersion in media, making them well-suited for bio-sensing. With functionalized MNPs, the ability to easily capture low concentrations of DNA (in the femto- and pico-molar range) has been shown to achieve comparable or better sensitivity than the current best qPCR detection systems. With a simple set-up and ease-of-use to determine results, functionalized DNA nanoparticles have a great advantage for detecting DNA in small quantities when compared to other methods of forensic evidence screening. Objectives of the project include identifying efficient and sensitive targets for detecting human and male DNA, protocol optimization, and evaluating the developed system with various types of mock and non-probative samples. Preliminary data demonstrate the system's ability to successfully sequester DNA from serially diluted samples and directly quantitate it without PCR amplification. Research to develop a low-cost system that can easily detect the presence and quantity of human DNA and human male-specific DNA (with a high degree of sensitivity), will be of tremendous societal value in reducing crime scene evidence backlogs, especially for sexual assault kits. This new test will have high sensitivity; only a small portion of the collected evidence sample will need to be screened to find the most probative samples for DNA profile processing.

2018-R2-CX-0019:	Raman Spectroscopy for Body Fluid Investigation
Amount:	\$97,328
PI:	Marisia A. Fikiet
Status:	Ongoing

This project continues the research on a new method of body fluid identification and furthers its field capabilities. This method of identification uses Raman spectroscopy and advanced chemometrics to distinguish between body fluids. It is an improvement on current methods because it is nondestructive, with simple sample preparation and confirmatory testing. The first goal of this research project is to determine the limit of detection and limit of identification of our current Raman method for sweat and vaginal fluid. The sweat samples will be from both genders and three races: Caucasian, Hispanic, and African American. The vaginal fluid samples will also include the three races. For the first goal, different volumes of the two body fluids will be deposited and mapped with our Raman microscope. The limit of identification will be found, using statistical models. The limit of identification will be found, using the standard analytical method of three times the standard deviation of the noise. The second goal of the research is to prepare and sample simulated evidence. The simulated evidence will be prepared with blood, semen, saliva, sweat, and vaginal fluid from a range of races and genders to encompass all possible variations. Preparation parameters for the evidence will include substrate variation and mixtures of body fluids. Each parameter will first be tested alone so that optimal sampling parameters can be found for each condition. The final step of the second goal will be to combine all of the variables into one sample of simulated evidence. Several pieces of evidence will be made in order to encompass several different conditions. Modifications will be made to our current method to account for the effects of different parameters. This research will validate our technique and help prepare it for real-life application. Annual interim reports will be given as well as a final report. Products from this research will be data sets, analytical figures of merit, and possible statistical models. Spectra data will be archived at .spc files as well as in MATLAB data sets. Statistical models will be saved as .mat files.

2017-NE-BX-0001:	Implementation of Epigenetics into Forensic Science: Development of a PCR Based Multiplex for the Simultaneous Analysis of Age and Body Fluid Identification
Amount:	\$368,512
PI:	Bruce McCord
Status:	Ongoing

Recent work on epigenetic methylation for age-based correlations has determined that these markers are cell-type specific. Thus, to determine a suspect's age using epigenetics, one must first determine the body fluid type left at the crime scene. It is the goal of this proposal to develop an epigenetic multiplex for the simultaneous and trace determination of a suspect's age and body fluid type that includes semen, vaginal epithelia, saliva, and blood. This project will involve more than 120 subjects who will donate blood, saliva, vaginal epithelia, or semen. Subjects will also contribute data on their biological age. First, the researchers will identify and combine a set of body fluid-specific age markers into a multiplex for the simultaneous determination of body fluid type and suspect's age. Second, the

researchers will test these markers using a massively parallel sequencer in a manner similar to that used for existing forensic kits. This kit will be validated using SWGDAM guidelines. The importance of this research should be self-evident to any forensic scientist. First, the determination of tissue type can be critical when levels are too low for conventional serology, or in child abuse where innocent transfer of DNA from skin or sweat from an abuser might be expected to be present on the child, but the presence of semen would not. Second, the determination of age is critical as an investigative lead for suspects who are not present in a database. Once the methylation status is defined in each DNA fragment amplified by the multiplex assay, a software package will be developed to define the cell type and age, along with the relative uncertainty in the estimate. The researchers will utilize an approach based on machine learning. The output of the program will define the body fluid type of the DNA recovered from the crime scene, determine if a mixture is present, and provide the age of the suspect(s).

2017-DN-BX-0176:	Laboratory Efficiency and Capacity Gains through Infrastructure Improvement
Amount:	\$114,000
PI:	Peter Stout
Status:	Ongoing

The Houston Forensic Science Center (HFSC) will use this funding to reduce the total turnaround time for drug-facilitated sexual assault kits by increasing the capacity and operating efficiency of HFSC's Toxicology and Forensic Biology/DNA sections. HFSC plans to locate, renovate, and lease an offsite building for HFSC's Crime Scene Unit (CSU). CSU will implement tracking software that will allow for monitoring of sexual assault kits and related toxicology kits throughout the testing process.

2017-DN-BX-0177:	FY 2017 Forensic DNA Laboratory Efficiency Improvement and Capacity Enhancement Program
Amount:	\$749,748
PI:	Jason Linder
Status:	Ongoing

The State of Nebraska will use this funding to eliminate the untested sexual assault kit backlog over a three-year period and to place all eligible DNA profiles into CODIS. The project will fund two additional forensic scientists in the Biology Unit to be dedicated to the untested SAK project. In addition, the Biology Unit will purchase computers and software licenses for the following specialized data analysis software packages: GMID-X, ArmedXpert, and STRMix for the forensic scientists dedicated to this project.

2017-DN-BX-0135:	Raman Spectroscopy for Analyzing Body Fluid Traces: Universal Method Development
Amount:	\$681,275
PI:	Igor K. Lednev
Status:	Ongoing

The proposed study is a continuation of an ongoing research project ultimately targeting the development of an easy-to-use, portable Raman spectroscopic instrument for the rapid, nondestructive, and confirmatory identification of body fluid traces recovered at crime scenes. This new methodology will allow crime scene investigators to identify all major body fluids using one instrument and retrieve information about the donor, which could potentially include sex, race, and age. The objectives for this particular project will bring the researchers' method closer to a universal method that will work regardless of substrate and donor variation and would be a black box type instrument. The six objectives the researchers will focus on are to (i) determine if disease state fluids affect our current method of body fluid differentiation; (ii) determine if time since deposition of menstrual blood can be determined, and if there is a time point after which peripheral and menstrual blood can't be differentiated; (iii) use a statistical method based on multivariate curve resolution (MCR) to deal with body fluid stains on interfering substrates; (iv) verify the self-reported sex of some of our donors with PCR; (v) create a hierarchical model in the move toward a black box instrument; (vi) add urine to the list of body fluids that we can differentiate with our current method. The researchers will be advised by Director Ray A. Wickenheiser and his colleagues at the New York State Police Forensic Investigation Center throughout the proposed project, providing valuable insights of importance to practitioners. In

addition, Dr. Michael Sikirca of Forensic Medical Services will be helping to obtain some disease state fluids and Allison Eastman of Forensic DNA Consulting, LLC, will advise on adapting DNA protocols for sex typing. Body fluid samples will be purchased from a biological supplier to represent a genetically diverse donor population. Samples will be measured using a Raman microspectrometer, and the spectra will be analyzed using advanced chemometrics and statistical modeling. Regression and classification models will be built using calibration data sets and then tested with external validation data sets. The work will be carried out over three years at the University at Albany, State University of New York, in Albany, New York. All results from the proposed work will be published in peer-reviewed academic journals, submitted in semi-annual and final progress reports, and presented at professional conferences.

2018-DN-BX-0163:	State of New Hampshire Sexual Assault Forensic Evidence-Inventory, Tracking, and Reporting Program
Amount:	\$333,558
PI:	Thomas Kaempfer
Status:	Ongoing

The New Hampshire Department of Justice (NH DOJ) has identified systemic issues in the tracking of sexual assault kits throughout the state. With these funds, the NH DOJ will hire a program specialist to develop and initiate a tracking program for sexual assault kits, including a website accessible for victims to log-in and see where their kit is in the system. The specialist will work with victims, local police departments, and prosecuting offices to ensure that cases are properly investigated and prosecuted. NH DOJ will work with the Portland Police Department in Oregon to implement Portland's Sexual Assault Management Software (SAMS) in New Hampshire. SAMS has been successful in Oregon, and NH DOJ will be able to fix a systemic problem in the state with its implementation.

2018-VA-CX-0003:	An Evaluation of Victim Centered, Trauma Informed Interview Training for Sexual Assault Investigators using Standardized Patient Actors: A Randomized Controlled Trial
Amount:	\$335,131
PI:	Bradley Campbell
Status:	Ongoing

The applicant proposes a study to examine the effectiveness of trauma-informed interview training coupled with an established healthcare training method – standardized patient training – on improving law enforcement investigators' performance in interviews with sexual assault victims. In the health care field, standardized patient training programs use actors to portray patients by simulating real symptoms and problems. This training exercise has proven successful for improving nursing and medical students' performance in simulated encounters with patients. Specifically, standardized patient training participants have been found to show more empathy toward patients, deliver negative prognoses in a more compassionate manner, and provide more detail regarding patient care options. The proposed study will use a randomized controlled trial involving approximately 160 to 320 police investigators with varying levels of investigative experience with sexual assault victims. Investigators will participate in a 40-hour training program focused on improving responses to survivors of sexual assault by exposing participants to victim-centered, trauma-informed interview techniques. A portion of the training will use standardized patients to portray survivors of sexual victimization in simulated interviews with program participants. Simulated interviews will be video and audio recorded. The control group (N = 80-160 investigators) will participate in simulated interviews before training, and the experimental group (N = 80-160 investigators) will participate in simulated interviews after receiving training. Indicators of rape myth acceptance, perceptions of victims, knowledge of laws and victim-centered/trauma-informed interview practices, and personality traits (e.g., self-control) will be assessed pre- and post-intervention. All measures will be collected pre-intervention, post-intervention, and four months after training is received. Additionally, the applicant will code recordings of interviews to assess any differences in interview performance (e.g., use of victim-centered, trauma-informed techniques) between the control and experimental groups.

2018-VA-CX-0004:	Enhancing Foundational Validity of Forensic Findings in Medico-legal Strangulation Examinations
Amount:	\$726,344
PI:	Kathryn Laughon
Status:	Ongoing

The overarching goal of this study is to enhance prosecution of strangulation crimes by strengthening the scientific validity of interpretation of forensic findings. This proposal uses machine learning and other sophisticated statistical modeling techniques to enhance court-based decision-making in the investigation and/or prosecution of crimes involving strangulation. Probabilistic modeling will be used to quantify the certainty/uncertainty that a constellation of injury patterns are suggestive of strangulation by making data-based comparisons of assaults against women with and without reported strangulation. Data will come from forensic exams of strangulation and non-strangulation cases from forensic nurse examiner programs in Virginia (N = 1,050 since 2017) and Arizona (N = 18,000 since 1998). This project will develop and disseminate guidelines for forensic examiners, particularly forensic nurse examiners, to use in understanding and applying the findings from this study in evidentiary proceedings.

2018-NE-BX-0001:	Autosomal DNA-STR Profiling of Directly Captured Spermatozoa from Post-Coital (3-10 Days) Cervico-Vaginal Samples
Amount:	\$600,704
PI:	Jack Ballantyne & Erin Hanson
Status:	Ongoing

Some victims of sexual assault provide vaginal samples more than 36-48 hours after the incident. In these cases, the ability to obtain a standard DNA (autosomal STR, aSTR) profile of the semen donor from the living victim diminishes rapidly as the post-coital interval is extended; normally, it can't be obtained more than 3 days after the incident. The proposed methods should, for the first time, permit the recovery of single-source CODIS-eligible aSTR profiles from the semen donor in extended-interval (4-10 days) post-coital cervicovaginal swabs. We hypothesize that a viable approach to be able to obtain aSTR profiles from extended-interval post-coital samples would be to carry out direct aSTR typing on selectively enriched, purified, and pooled rare individual sperm cells obtained by direct physical recovery from the sample, using simplified micromanipulation or digital cell sorting. Over the two-year project period, we propose to test and evaluate two methods, namely, simplified manual micromanipulation and digital cell sorting (DEPArray™). Using micromanipulation, sperm cells will be collected manually, using a tungsten needle and water-soluble adhesive, permitting direct transfer into collection tubes for analysis. Using digital cell sorting, cell-specific fluorescent labeling of epithelial and sperm cell populations permit the identification of sperm in admixed samples. Through the use of di-electrophoretic cages, sperm can be moved through a microfluidic cartridge into a chamber for collection. Method optimization and performance evaluation will be carried out with vaginal secretions/semen mixtures, using anonymous semen (n = 15) and vaginal secretions (n = 10) donors. This will determine the number of pooled sperm required to obtain a probative aSTR profile. Subsequently, optimized methods will be used to recover and perform aSTR profiling on appropriate numbers of pooled single sperm from bona fide post-coital cervicovaginal swabs from 10 volunteer couples, self-collected 3-10 days after individual acts of sexual intercourse. For each time point, a pre-coital swab will be collected on Day 0, after at least 10 days of abstinence, to ensure no prior presence of male DNA. The DNA-typing results will be compared to reference genotypes, and the quality of obtained STR profiles will be evaluated (i.e., allele/locus drop-out, allele drop-in, and variation in profile recovery as the time since intercourse increases). Biological and technical replicates will be used to ensure the reliability and validity of results. The project findings will be disseminated via publication in peer-reviewed forensic journals and presentations at national/international forensics meetings.

2018-MU-MU-0013:	Body Fluid Analysis Detection and Identification by Surface Enhanced Raman Spectroscopy for Forensic Scientists
Amount:	\$462,091
PI:	Lawrence D. Ziegler
Status:	Ongoing

The purpose of this proposal is to optimize the capabilities of surface-enhanced Raman spectroscopy (SERS) for the detection and identification of trace amounts of blood, semen, vaginal fluid, saliva, and their mixtures for forensic purposes. The continued development of this optically based methodology will lead to a single instrumental platform for the rapid, sensitive, easy-to-use, cost-effective, on-site, nondestructive detection and confirmatory identification of human body fluids commonly found at crime scenes. No such single platform is currently available for this purpose. It will allow the rapid confirmatory identification of biological materials/fluids with minimal destruction to evidence samples at crime scene locations or from evidence taken from crime scenes. Due to the sensitivity of SERS, suspected human body fluid samples that may be invisible to the eye (but may be located with the aid of alternate light sources, etc.) may be identified, leaving a sufficient quantity for subsequent DNA analysis. In forensic lab settings, SERS can

be used to identify the original body fluid at the same time as genetic analysis. In addition, distinguishing different body fluid mixtures via SERS can play an important role in criminal prosecution of sexual assault crimes. The rapid speed of confirmatory SERS in-field measurements have the capability to inform criminal investigation directions prior to traditional confirmatory laboratory testing. This project leverages the results of a recent NIJ-funded project that demonstrated the capabilities of this optical approach for trace body fluid identification. Optimized sample protocols, effects of household substrates, body fluid mixture resolution, development of SERS active swabs, and blinded body fluid identification tests will be carried out. Our high-performance portable Raman microscope will be used to demonstrate in-field capabilities of this technology and tested by forensic scientists at the Boston Police Crime Laboratory. At the end of this award period, all of the elements for an integrated, SERS-based, portable trace body fluid detection and identification platform (sample preparation protocols, spectral reference library, software procedures) will be available for field deployment.

2018-MU-BX-0002:	Classification Procedure for Lubricant Stains and Samples Collected from Sexual Assaults
Amount:	\$354,195
PI:	Candice Bridge
Status:	Ongoing

Sexual assaults are an unfortunate reality in modern society, which includes situations in which the assailant can be known or unknown. Classifying a sample of an unknown sexual lubricant without directly comparing it to a known sample is not a capability that U.S. forensic labs currently possess. Analysis of lubricants to identify and compare trace amounts in sexual assault cases is relatively new in the field of forensic science when compared to other disciplines dealing with trace evidence. Most research focuses on the identification of trace levels of polymers from the main lubricant component, but it is necessary to identify the necessary parameters to conduct daily analysis of unknown lubricants, i.e., post-coitus residue collection, storage, extraction, and identification. The development of the Sexual Assault Lubricant (SAL) database provides the foundation for a more objective forensic analysis of lubricants. This database provides a way to classify unknown samples collected in sexual assault cases; however, to promote its use as a valuable tool, it is necessary to validate the database with real-world samples and analysis. A characterization scheme for unknown lubricants has been developed with funds from NIJ grant 2016-NE-RD-0001; the next step is to define a way to operationalize its use for sexual assault cases. This can be achieved by determining the accuracy of analyses of true unknown and known samples, considering that many of the minor and unique components can be absorbed into the human skin or be worn away during any activity, sexual or not. This project aims to develop the necessary guidelines for forensic laboratories to analyze unknown lubricant samples, including methods of collection, storage, screening, lubricant extraction protocols, analysis, and classification. To provide direct comparison between degraded unknown samples, it is necessary to develop a protocol for degrading known lubricant samples in the laboratory for analytical comparison. This will allow for the determination of false positive and false negative error rates throughout the forensic analytical process. At that end of the project, optimal collection, storage, and extraction protocols will be developed. Additionally, an evaluation of classifying true unknown lubricants that were purchased for this project specifically, and those residues collected after sexual intercourse, will be conducted to determine error rates. Newly acquired lubricant samples will be added to the SAL database at the end of the project.

2018-DU-BX-0178:	Identification of Minor Dye Components of Fibers via Integrating-Cavity-Enhanced Raman Spectroscopy
Amount:	\$580,622
PI:	Hergen Eilers
Status:	Ongoing

The characterization and analysis of trace evidence is part of the standard protocol during forensic investigations. Trace evidence can potentially be used to link a suspect with a victim, or a suspect/victim with a location. Textile fibers are one type of trace evidence, and the color of the fiber is one of its most important properties. Fibers are typically analyzed using a variety of techniques and compared with a reference. First, nondestructive techniques such as light microscopy and UV/Vis microspectrophotometry are used. If these don't yield conclusive results, destructive techniques such as thin-layer chromatography and gas chromatography/mass spectrometry are used. Recently, Raman spectroscopy has been evaluated as an analytical tool for the characterization of fibers. Besides its nondestructive nature, Raman spectroscopy offers other advantages: It requires almost no sample preparation, it yields more distinctive spectra than UV/VIS/NIR spectra, and it provides unique sample information. Although Raman

spectroscopy is a promising tool, it has its own set of limitations, the main one being sample fluorescence, which is typically orders of magnitude stronger than the actual Raman signal. Fluorescence can, in principle, be avoided by measuring anti-Stokes Raman spectra instead of Stokes Raman spectra. However, the intensity of anti-Stokes Raman spectra is typically too low. Textile fibers are often colored using a mixture of dyes. Due to the limitations described, Raman spectroscopy can often only identify the dye with the highest concentration or the one resulting in the strongest Raman scattering peaks. Changing the wavelength of the Raman laser can sometimes help in identifying a secondary dye. Given that there exist thousands of dyes, however, the ability to identify only one or two dyes within a dye mixture can severely limit the usefulness of Raman spectroscopy for forensic purposes. The goal of this project is to evaluate integrating-cavity-enhanced Raman spectroscopy (ICERS) to measure anti-Stokes Raman spectra for the characterization of dyed fibers. ICERS has been developed for the ultra-sensitive identification and characterization of materials, and enhancements of five orders of magnitude have been demonstrated. Using ICERS to measure anti-Stokes Raman spectra eliminates the fluorescence background, and the cavity design amplifies the anti-Stokes Raman signal. The combination of the two makes it possible to detect, identify, and characterize minor dye components without interference from fluorescence. Such an approach is expected to reveal more minor dye components, which could help narrow down the source of the fiber in question.

2018-VA-CX-0005:	Assessing an Innovative Response to Intimate Partner Violence Related Strangulation
Amount:	\$329,381
PI:	Katherine M. Brown
Status:	Ongoing

According to recent studies, approximately 2 million injuries and 1,300 deaths result from intimate partner violence (IPV) incidents each year in the United States. In fact, it is estimated that between 22% and 35% of women who visit the emergency room are there for problems related to IPV, and one out of every three female trauma patients is a victim of IPV. Although some research indicates that 40% of IPV victims reported strangulation as part of an IPV incident, only about 10% actually reported it to law enforcement and emergency personnel. Furthermore, victims of IPV who experience nonfatal strangulation are seven times more likely to be victims of attempted homicide, and eight times more likely to subsequently become victims of a homicide. In addition to the increased risk of lethality from strangulation within IPV incidents, there are studies and anecdotal evidence that men who strangle their partners are more likely to assault and kill law enforcement officers. This study will examine a new ordinance that (1) defines a protocol for addressing strangulation, (2) provides training for first responders (police, fire, and EMS/paramedics), (3) develops new assessment instruments to improve the identification of IPV asphyxiation, and (4) uses specific intervention strategies for strangulation across multiple agencies. To determine the effectiveness of the new initiative, this study uses a quasi-experimental design to measure success. The purpose of the study is to identify effective policies for reducing IPV strangulation, improving health and safety outcomes for victims, and advancing officer safety during domestic violence calls.

2019-NE-BX-0003:	Bio-inspired Material-integrated Beads for Differential Extraction of Sperm in Forensic Applications
Amount:	\$499,545
PI:	Utkan Demirci
Status:	Open

Rapid and efficient processing of sexual assault evidence will accelerate forensic investigation and decrease casework backlogs. Therefore, the standardized protocols currently used in forensic laboratories will need continued innovation to handle the increasing number and complexity of samples being submitted to forensic labs. To date, there are currently no rapid differential extraction technology, which includes both sperm isolation and efficient lysis is available. Here, we propose to develop a novel sperm capture and differential extraction strategy that utilizes bio-inspired material integrated bead platform. The bio-inspired material-integrated beads will (i) selectively capture sperm from sexual assault samples, (ii) be sensitive within the forensic cut-off (with $\pm 10\%$ error range), provide cost effective solution and (iii) handle small volume of sample (<100 μ L). This strategy can rapidly isolate sperm within 20 minutes of incubation that will prepare the extracted sample for downstream forensic analysis and ultimately help accelerate forensic investigation and reduce casework backlogs. The research has the following aims: (1) First, develop a specific surface chemistry to modify magnetic beads with a unique sperm capture reagent, and subsequently develop an integrated system with bio-inspired material beads to capture and quantitate the number of

sperm in a forensic sample and to develop specific protocols for forensic applications with the system, (2) evaluate the bio-inspired material-integrated bead platform with a statistically relevant number of adjudicated sexual assault samples through collaboration with the Broward Sheriff’s Office Forensic Laboratory, and (3) conduct a Developmental Validation of the system including sensitivity, precision and accuracy, reproducibility, stability studies and correlation with currently used methods, resulting in commercialization of a next generation system to accelerate the differential extraction process for forensic investigations.

2019-MU-MU-0095:	Douglas County, Nebraska Sexual Assault Kit Research Project
Amount:	\$657,908
PI:	Tara Richards
Status:	Open

The proposed project will employ a variety of methods to evaluate the activities undertaken by law enforcement, prosecutors, and victim advocates that are part of a project funded by the Bureau of Justice Assistance as part of the Omaha, Nebraska’s Sexual Assault Kit Initiative. As proposed, this study will evaluate the processes and outcomes related to victim notifications and continued victim support and sexual assault kit (SAK) testing, investigations, and prosecutions for approximately 2,000 previously untested kits. In addition, the study will calculate the cost of testing SAKs versus the cost of investigating and prosecuting new crimes perpetrated by offenders during the period of time a kit associated with their DNA profile was left untested. Moreover, the applicant will assess the impact of using the Violent Crime Apprehension Program (ViCAP) in conjunction with, or independent of, the Combined DNA Index System (CODIS) in identifying investigatory leads associated with SAKs. The research team proposes to (1) focus heavily on empirically testing “best practices” regarding victim notification by employing a randomized controlled trial (RCT) to test the effects of different victim notification methods and (2) examine victim experiences regarding participation, empowerment, and satisfaction associated with testing SAKs. Project activities include the creation of a database containing characteristics of cases associated with untested kits (i.e., victim, case, suspect, and neighborhood factors) and the causes for not testing them. A comparison will be conducted of approximately 500 kits that were previously tested with a random sample of 500 untested kits to determine factors that may impact decisions to test, or not test, SAKs. In addition, a survey of police officers, prosecutors, and advocates will be administered at two-time intervals (January 2020 and December 2021) about perceptions of the Omaha systems’ (a) capacity to respond to sexual assault, and (b) interagency collaboration between sexual assault responders. Survey data will be supplemented by in-depth interviews with police investigators to identify additional gaps in response (e.g., training needs, policy improvements). Also, the applicant will randomize the way victims are notified of SAK testing results that are associated with a CODIS or ViCAP hit under three conditions: (1) phone notification from an advocate; (2) in-person notification by an advocate at a neutral location; and (3) in-person notification by an advocate and law enforcement officer at a neutral location). Data on outcomes of victim notification will be collected using surveys of victims, officers, and advocates. Finally, the applicant will estimate the costs and benefits associated with testing, investigating, and prosecuting untested SAKs using criminal history data for each offender involved in a CODIS or ViCAP hit and the National Institutes of Health crime cost estimates.

2019-NE-BX-0002:	Adaptation of the DNase I Procedure to the Biomek® NXP Robotic Platform for More Efficient and Automated Sexual Assault Sample Processing
Amount:	\$250,636
PI:	Susan Greenspoon
Status:	Open

In the United States, there were an estimated 298,410 reported sexual assaults in 2016. Nationwide, there are untested sexual assault kits on the shelves of law enforcement agencies, despite the fact that sexual assault evidence is one of the most common types of evidence submitted to forensic laboratories. Thus, the Virginia Department of Forensic Science (DFS), like many forensic laboratories, is adopting new techniques, instrumentation and procedures to help reduce the backlog and expedite sexual assault case processing. The goal of this proposal is to adapt a modification of the widely used differential extraction procedure (DE) to separate sperm cells from non-sperm cells, to a specific robotic platform. The modified procedure utilizes the DNase I enzyme for rapid elimination of non-sperm DNA carry-over into the sperm cell fraction thereby making the process more efficient and the resulting DNA profile data easier to interpret. The automation of this modified DE procedure will be designed as a subprogram, to be utilized prior to current robotic casework processing and thus, will integrate seamlessly into casework sample processes. Moreover, it will lessen the time expended by examiners in preparation of sexual assault samples for automated DNA purification and processing. Published and unpublished manual and automated protocols for this procedure will be used for the

starting conditions, which will then be optimized for casework application using the Biomek® NXP automation platform and current DNA extraction chemistries using the DNA IQ System. Initially, a manual procedure will be developed that is compatible with current sexual assault sample DNA purification and downstream DNA profiling. Once the manual process is fully optimized, the procedure will be adapted to automation using the Biomek® NXP robotic platform. All method development and optimization will involve comparisons with current, unmodified (standard protocol) manual and semi-automated DE procedure using quantitative and qualitative metrics. The new modified differential extraction procedure utilizing DNase I will be robustly and fully validated to ensure that DNA sample quality and quantity is either as good or superior to current manual and automated procedures.

2019-NE-BX-0006:	Nanobiosensor Arrays for On-Site Multiplexed Detection of Protein Markers to Identify Forensically Relevant Body Fluids
Amount:	\$600,554
PI:	Ashok Mulchandani
Status:	Open

Identifying the body fluid left at a crime scene is an important component in forensic science, as knowing what is the body fluid at many times is the key in a criminal investigation and what is considered in court. While tests for detection of body fluids are available, they have low sensitivity and selectivity, consume significant quantity of valuable sample and are labor intensive. Furthermore, current identification methods are limited to one body fluid at a time and hence are inherently more time consuming, require large sample volume and is expensive and thus can negatively influence the outcome of a court case.

The objective of the proposed research is to develop a point-of-use/on-site multiplexed nanobiosensor array that is digital/electronic for identification of multiple body fluids – blood, saliva, semen, urine and sweat - through highly sensitive, quantitative, selective, facile, rapid and cost-effective detection of ten body fluids protein biomarkers. To detect these protein biomarkers simultaneously in a small sample volume, we will develop an array consisting of ten nanobiosensors, each consisting of ultrahigh sensitivity single-walled carbon nanotubes chemiresistor transducer functionalized with an antibody of high specificity/selectivity against a specific target antigen. The ability of multiplexed and ultrahigh sensitive quantitative analysis provided by the array nanobiosensor would increase specificity of analysis and thereby make body fluid identification infallible, reduce sample requirement, reduce time, lower forensic analysis cost and make identification more infallible. In order to make these sensors amenable to on-site, multiplexed analysis from a small single sample, light weight, semi/fully-automated, easy-to-use, low-cost, disposable and with no/low environmental burden, single-walled carbon nanotubes chemiresistor nanobiosensors will be integrated with paper-based microfluidics. Further, to facilitate performing forensic analysis at remote crime scenes, i.e. on-site, with various environmental conditions the sensor platform will be integrated to a mobile/smartphone platform for analysis, data processing and communication. We expect that the proposed sensor system is potentially transformative because the expected outcomes will significantly improve forensic analysis of body fluids and thereby investigative lead and case investigation.

2019-NE-BX-0005:	Verification and Evaluation of a miRNA Panel for Body Fluid Identification using DNA Extracts
Amount:	\$169,628
PI:	Sarah Williams
Status:	Open

Molecular-based approaches for biological source identification are of great interest in the forensic community because of a lack of sensitivity and specificity in current methods. MicroRNAs (miRNAs) have been the subject of many body fluid identification studies due to their robust nature and tissue specificity; however, analysis requires a separate RNA extraction, requiring an additional step in the forensic analysis workflow. The purpose of this project is to build on previous work in our laboratory, wherein we identified a panel of 9 miRNAs that can identify blood, semen, menstrual secretions, vaginal secretions, feces, urine, and saliva. As part of two previously NIJ-funded projects, the researchers conducted a pilot study in which they showed that miRNAs are consistently detectable using several DNA extraction methods commonly utilized in the field for forensic casework. They reported that the miRNA panel for forensic body fluid identification was evaluated using DNA extracts of semen, saliva, blood, and menstrual secretions, and was largely concordant with results from samples deriving from RNA extracts.

For the proposed project, they will evaluate a larger sample set of DNA extracts and validate the full body fluid panel that was previously validated for RNA extracts using RT-qPCR analysis of DNA extracts. They will perform DNA extractions and query a population sample set of 50 individuals for consistency in differential expression of the miRNA panel, and therefore body fluid identification. The body fluid samples will vary in age, ethnicity, and gender (where appropriate) of donor. Additionally, 200 mock evidence samples extracted with commonly used DNA extraction methods will be subjected to environmental and chemical insults, and over time in the same individuals to verify our previous findings in DNA extracts. Once validated through this project, a simple RT-qPCR assay can be used with a small portion of the DNA extract to identify the body fluid(s) present in the evidence, with no additional sample use or personnel time in producing a separate RNA extract. Expected technology transition products for this technology will include 1-2 published manuscripts and two to four conference presentations, in addition to the interim and final reports.

2020-DQ-BX-0015:	Comparative Assessment of Emerging Technologies for Body Fluid Identification
Amount:	\$501,115
PI:	Heather McKiernan
Status:	Open

Under previous NIJ awards, targeted Next Generation Serological assays for human body fluids have been developed leveraging emerging technologies such as mRNA sequencing, epigenetics, and proteomics. While an mRNA body fluid assay was the basis for a collaborative exercise between participating EUROFORGEN and EDNAP laboratories, no such study to date has compared these emerging serological assays in order to test their efficiency related to each other as well as against contemporary immunochromatographic tests. This proposed study will leverage collaborations amongst four participating laboratories in order to compare the sensitivity and specificity for each serological workflow. In consultation with the Applied Genetics Group at NIST, homogeneous samples containing body fluid stains of various human origin will be generated, mitigating potential variability from front-end sampling techniques so as to directly compare results among laboratories and methodologies. Samples will be prepared in two phases. In phase 1, semen, venous blood, saliva, and vaginal fluid/menstrual blood will be prepared in triplicate across two concentrations, allowing for system alignments for analytical protocols and internal interpretation guidelines. All samples will be simultaneously analyzed using a traditional capillary electrophoretic workflow for STR analysis, demonstrating compatibility of all body fluid identification workflows with current STR typing technologies. Blind mock casework samples including degraded biological samples, mixtures commonly encountered in forensic scenarios, samples treated with chemical insult, dilutions of single-source biological samples, and non-target/non-human samples will be prepared and tested in Phase 2. Instances where samples generate discordant results across methodologies will be identified and evaluated to ascertain why discrepant results were obtained. Samples from both phases will be analyzed by caseworking analysts using RSID™-Blood, RSID™-Semen, and RSID-Saliva (Independent Forensics) as well as the Menstrual Blood PMB Test (Seratec). Using methodologies developed under previous NIJ funding, researchers will conduct mRNA sequencing using NGS body fluid identification assays developed on both the MiSeq (Illumina) and Ion S5 (ThermoFisher Scientific) platforms. Proteomic analysis will be performed utilizing the 6495 triple quadrupole mass spectrometer (QQQ) coupled to a 1290 ultra-high-performance liquid chromatography system (Agilent Technologies) for mass analysis, while epigenetic analysis will be performed using a Q48 Autoprep Pyrosequencer (QIAGEN). This proposal will help align research surrounding emerging techniques for body fluid identification with operational forensic laboratory needs, while generating valuable information to assist with the technology transfer associated with emerging body fluid identification, helping better inform future research directions.

2020-R2-CX-0031:	Developmental Evaluation of a Combinatorial qPCR Multiplex for Forensic Body Fluid Identification
Amount:	\$49,994
PI:	Carolyn Lewis
Status:	Open

Forensic body fluid identification (BFID) is an essential step in the biological evidence workflow that can provide critical context clues for crime reconstruction, particularly in sexual assault cases. The ability to link a DNA profile to a cell type or body fluid is important when considering the nature of forensic evidence, where mixtures of body fluids from multiple individuals are commonly observed. Current serological techniques involve enzymatic or immunology-based assays that lack sensitivity/specificity and are subjective to forensic analysts; therefore, molecular

methods, such as microRNA (miRNA) analysis or microbial classification, have been extensively researched in the forensic community. Recognition of advantages and disadvantages of each method have led to the proposition that combining molecular markers would increase discrimination efficiency of multiple body fluids from a single assay. While microbial taxonomic classification for BFID is successful in body fluids with high abundances of bacteria, such as vaginal secretions and saliva, miRNA analysis shows promise in body fluids with less bacterial content, such as venous blood, menstrual secretions, and urine. Since miRNAs co-extract with DNA, a separate RNA extraction is not necessary, eliminating a major hurdle to casework implementation. This study aims to synergize on the benefits of both miRNAs and microbial DNA to characterize X body fluids from a single DNA extract. The project will be conducted over 12 months to develop qPCR assay that distinguishes between six forensically relevant body fluids using a combination of miRNAs and microbial DNA targets previously demonstrated as body fluid specific. Microbial species will be used to identify vaginal secretions, feces, and saliva due to their high bacterial content, while semen, blood, and menstrual secretions will be discriminated through miRNA analysis. If possible, autosomal and Y markers will be incorporated to demonstrate human and male DNA in the samples, respectively. The designed assays will be optimized in a qPCR multiplex, allowing for simultaneous identification of all six body fluids at the quantification step of the current DNA workflow. Forensic utility will be addressed through developmental validation studies that demonstrate body fluid specificity in a large population, assay sensitivity and the ability to discriminate body fluids in samples of mixed origin. In addition to the annual and final technical reports, expected scholarly products include a doctoral dissertation, at least one publication in a peer-reviewed journal, and two presentations at scientific meetings.

2020-DQ-BX-0005:	Efficient and Effective SNP System for Analysis of Highly Degraded DNA Samples
Amount:	\$444,723
PI:	Magdalena Bus
Status:	Open

Forensic DNA typing is a highly sensitive set of methodologies, such that a minute amount of DNA can be analyzed for a wide range of applications including identifying missing persons from degraded human remains and analysis of crime scene biological evidence. A single hair shaft can provide answers to support investigative leads. Because of this sensitivity, there has been an increased demand to analyze challenging (i.e., low quantity or low quality) samples. Analysis of touch samples, hairs, and human remains pushes the limits of current technologies, especially when samples are highly degraded. To date there has not been a technology that can accommodate such samples. Reverse complement polymerase chain reaction (RC-PCR) is an innovative, one-step, single-tube PCR target enrichment technology adapted for the amplification of highly degraded DNA and can be the solution to analyzing degraded samples. Based on work from a previously funded NIJ grant, a multiplex of 27 single nucleotide polymorphisms (SNPs) for human identification was developed. The SNPs are all contained within approximately 50 base long amplicons and the system has substantial sensitivity of detection, tested down to 60 picograms of input DNA. With the promising results from the initial study, the multiplex should be expanded to provide a high level of discrimination and developed with a concomitant robustness for forensic applications. The goals of this project are to expand the number of SNPs to 82 commonly used SNPs and enhance performance of the system through primer redesign, degenerate primers, and inhibition enhancers so that the most challenging of samples may be analyzed. The SNPs will be designed to reside within amplicons less than 100 bases in length. Increased number to the RC-PCR Human Identification panel will improve the overall power of discrimination. An enhanced robustness, demonstrated with standard validation testing, will enable the SNP panel to be applied to a variety of highly degraded and contaminated samples. The one-step, closed-tube process is conducive to automation, decreases the labor required to perform library preparation, and substantially reduces the probability of contamination due to less sample manipulation. The unique features of the RC-PCR technology lend itself to a seamless application to successfully target SNPs on highly degraded templates. Because of the reduced amplicon size and higher typing success, the RC-PCR method is anticipated to yield results with samples for which no or very limited data are obtained with standard DNA typing methods.

2020-DQ-BX-0014:	Evaluation of Nuclear DNA from Rootless Hair for Forensic Purposes
Amount:	\$747,384
PI:	Richard Green
Status:	Open

With this solicitation, NIJ seeks proposals for basic or applied research and development projects. An NIJ forensic science research and development grant supports a discrete, specified, circumscribed project that will: (1) increase the body of knowledge to guide and inform forensic science policy and practice, or (2) lead to the production of useful

material(s), device(s), system(s), or method(s) that have the potential for forensic application. The intent of this program is to direct the findings of basic scientific research; research and development in broader scientific fields applicable to forensic science; and ongoing forensic science research toward the development of highly-discriminating, accurate, reliable, cost-effective, and rapid methods for the identification, analysis, and interpretation of physical evidence for criminal justice purposes. Projects should address the challenges and needs of the forensic science community. The operational needs discussed at NIJ's FY 2016 Forensic Science TWG meeting may be found on NIJ.ojp.gov. Additional research needs of the forensic science community can be found at the Organization of Scientific Area Committees website. While the goals and deliverables of proposed projects do not necessarily need to result in immediate solutions to the posted challenges or needs, they should speak to them and produce knowledge that adds to work towards eventual resolution.

2020-75-CX-0014:	Forensic Tool to Identify Fall Characteristics in Infant Skull Fracture
Amount:	\$557,607
PI:	Brittany Coats
Status:	Open

Over 650,000 children are victims of abuse and neglect each year. Infants are particularly vulnerable and represent the age group most likely to experience a recurrence of maltreatment if the abuse is not detected. Child abuse cases, however, can be some of the most challenging cases for prosecutors, law enforcement professionals, and child protection advocates. No one other than the accused is typically present to witness the event, and children, especially infants, are too young to communicate what events led to their injuries. To confound matters, falls are the leading cause of non-fatal injury in infants, and the most common history provided in cases of child abuse. Therefore, distinguishing a truthful history of a fall from a false one proves to be a difficult, but important, task. Linear skull fractures are common in both accidental and abusive head trauma, but little is known about the mechanics of skull fracture in infants. Further, it is unknown how fall characteristics affect skull fracture patterns. Recently, we used fundamental fracture mechanics to develop a fracture-simulation framework. This framework is capable of predicting infant skull fracture patterns from head impact and, thus, enables exploration of the effect of fall characteristics, such as fall height and impact angle, on skull fracture length and orientation. This proposal will begin to translate the aforementioned fracture-simulation framework into a forensic tool capable of estimating fall height and impact location from images of skull fracture. A two-phase approach will be used to provide intermediary milestones within the project. In Phase 1, we will evaluate multiple supervised machine learning algorithms and identify the best one to estimate fall characteristics from images of fracture patterns. Concurrently, we will characterize the natural variability of skull thickness across the infant skull in a large dataset of infants. Using uncertainty quantification methods, we will then measure the effect of skull thickness distribution on skull fracture patterns in single events. In Phase 2, we will integrate the effects of skull thickness distribution into the machine learning algorithm and will evaluate the new tool against real-world cases of infant skull fracture from well-witnessed accidental falls. Successful completion of this project will provide the medical, legal, and forensic communities with data to understand skull fracture variability among infants and produce an image analysis tool capable of improving accuracy in identifying child abuse cases.

For an index of all grants, go to ojp.gov/sites/g/files/xyckuh241/files/archives/ncjrs/223572-grants-index.pdf.