

"Successfully Investigating Acquaintance Sexual Assault: A National Training Manual for Law Enforcement"

Developed by the *National Center for Women & Policing*, with support provided by the Violence Against Women Office, Office of Justice Programs (Grant #97-WE-VX-K004)

DNA Evidence and Issues

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DNA Evidence and Issues

Advances in technology have made DNA testing an established part of sexual assault investigation and prosecution, especially for cases in which identification is the primary issue. Moreover, these advances have rendered traditional serology identity testing for blood, saliva, and semen virtually obsolete.¹

- In 1996, for example, there were more than 17,000 cases involving forensic DNA in the United States alone. Most of these were sexual assault cases involving DNA testing of specimens collected from vaginal swabs and semen stains.²

The purpose of this module is to outline the potential contribution of DNA technology to the investigation and prosecution of sexual assault cases. We will also explore a number of the barriers we must first overcome to realize this potential, before concluding with specific guidelines for the investigator in collecting, analyzing, and using DNA evidence.

Nature and Purpose of DNA Evidence

DNA is found in all bodily fluids and tissues. In fact, it is found in every single cell of a person's body, and each cell has identical DNA. Because of this, DNA evidence collected from a crime scene can be used like a fingerprint to include or exclude a suspect in a particular case. It can also be used to link crime scenes either locally or on a state or national level.³

The primary purpose of DNA evidence in a sexual assault case is thus to identify an assailant and/or to prove sexual contact. Experienced investigators often say that they rejoice when a suspect denies engaging in sexual contact with the victim, because the case then provides the opportunity to make full use of forensic technology.

For this reason, it is recommended that a preliminary statement be obtained from the suspect as soon as possible in a sexual assault case. It is possible that the suspect will initially deny sexual contact where he would not have done so if given more time.

1 Weedn & Hicks, 1997

2 Weedn & Hicks, 1997

3 National Institute of Justice brochure (#BC 000614)

As we've stated repeatedly throughout this manual, however, the vast majority of sexual assaults are committed by someone known to the victim. In these cases, identification is not the issue because the defense will probably claim that the sexual activity was consensual. The value of DNA evidence in these cases where the victim and suspect know each other is therefore minimal.⁴

Even when the sexual assault is committed by a stranger, many suspects will raise a consent defense, so DNA evidence is of little use for the investigation.

A brief history of forensic DNA

The first sexual assault defendant was convicted in this country with the help of DNA evidence in 1987. The case was upheld on appeal the following year.⁵ Since that time, DNA analysis has been used in over 20,000 cases resulting in conviction.⁶ Historically, DNA technology has been used primarily as a prosecutorial weapon rather than an investigative tool. In other words, DNA evidence has generally been used to confirm the identity of someone already under suspicion, rather than assisting in the investigation and identification process.⁷

- There are, of course, exceptions where DNA technology has identified a suspect that would have otherwise remained undetected. For example, "in 1991, the Minnesota Bureau of Criminal Apprehension (BCA) Laboratory became the first state crime lab to identify a suspect on the basis of DNA alone."⁸
- An article included in the supplemental materials also describes the success of DNA matches in Florida and Virginia.

4 In those cases where the suspect admits sexual contact but claims it was consensual, detectives and prosecutors need to evaluate the need for forensic DNA. For example, if the victim bled from an injury sustained during the assault the detective might submit a lab request to detect blood, thereby corroborating the use of force.

5 Lewis, 1988; cited in Ledray, 1999, p.64

6 Gladwell, 1995

7 Asplen, 1999

8 Ledray, 1999, p.64

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Several recent, highly publicized cases have also illustrated the potential for DNA to exonerate individuals wrongfully convicted of rape or homicide.

For example, DNA technology has been used to free a number of men in prison for sexual assault, including 12 in 1992 and 28 in the next two years.⁹

In response to this situation, Attorney General Janet Reno created the National Commission on the Future of DNA Evidence. The official mandate of this Commission is to submit recommendations that will help ensure more effective use of DNA as a crime fighting tool and foster its use throughout the criminal justice system.¹⁰

- This includes using DNA evidence in cases where a suspect is known, by confirming the suspect's presence at the crime scene.
- It also includes cases in which the suspect is not known, and DNA evidence can be compared with known samples that have been collected from previous cases and catalogued in a database.¹¹

A new use for DNA evidence: Futuristic warrants and grand jury indictments

Yet another potential use for DNA evidence is to file a warrant for the arrest of an unnamed suspect before the statute of limitations for a particular crime expires. This approach is currently being taken in Milwaukee, Wisconsin, where a "futuristic warrant" based only on DNA identification has been brought against a John Doe suspect. The identification was seen as sufficient because Wisconsin law permits warrants to be brought against unnamed suspects based on other identifying characteristics. Only time and court decisions will tell, however, whether this type of futuristic warrant will withstand legal scrutiny, if the John Doe suspect is ever caught and convicted.

A similar DNA-based warrant has since been issued in Utah, and New York has been the first state to file a grand jury indictment of a John Doe suspect based solely on a DNA profile.

9 Butterfield, 1996; Sauer, 1993

10 Asplen, 1999

11 Asplen, 1999

What DNA (mostly) replaced: Trace evidence

Trace evidence includes items such as hairs, fibers, paint chips, glass shards, shoe prints, gun shot residue, arson/explosives and physical matches. Using this type of evidence, forensic scientists have been able to identify the source only on the basis of its general appearance and structural features. A sample report on such trace evidence is found in the supplementary materials.

- Unlike DNA, trace evidence rarely provides definitive identification. As a result, trace evidence is primarily useful only in cases that do not have DNA evidence; otherwise substantial resources can be wasted by crime laboratories screening for trace evidence that will never be analyzed.

This may change, however, with new technologies. For example, the Office of Justice Programs announced in February of 2000 the release of a publication addressing how human hair found at a crime scene may be matched with samples taken from a specific individual.

This publication is entitled "Trace evidence analysis of human hair by on-line supercritical fluid extraction-gas chromatography/mass spectrometry: A feasibility study." It is available from the National Institute of Justice website at www.ojp.gov/nij/ or the Department of Justice Response Center at 1-800-421-6770.

Of course, analysis for trace evidence will continue to be used for identification purposes in isolated situations. It will certainly be useful in those cases lacking DNA evidence. However, it can also be used in another way. For example, if both DNA and trace evidence are found in a sexual assault case, the DNA will be used to identify the assailant. In some of these cases, other assaults might be seen as related because of a similar modus operandi, suspect description or geographical area. If evidence collected in those cases does not contain relevant biological material, the trace evidence collected in the first case might be used to link it with both the other cases and the definitive identification provided by the DNA.

Finally, trace evidence can always be used for purposes other than identification. Trace evidence can be used to corroborate the victim's account of events, by linking the suspect with particular locations. For example, even if the suspect admits having sex with the victim, he may deny certain aspects of the event. If these aspects can be corroborated with trace evidence, this bolsters the credibility of both the

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victim and her account of what happened.

Sources of DNA evidence

The promise of DNA evidence for sexual assault investigation lies both in its widespread availability and longevity, as well as its unrivaled potential for identifying a suspect or proving that sexual contact took place. At the crime scene, DNA evidence can be collected from many kinds of biological specimens including blood, saliva, semen, hair, skin cells, bone, teeth, tissue, urine, feces, and vomit.

- For example, a suspect's DNA may be collected from saliva found on the victim's body or clothing; it can even be found on the victim's bra if she puts it on after the suspect has kissed, licked, or sucked on her breasts.
- DNA evidence can also be collected from anything that the suspect put in his mouth, including chewing gum, cigarette butts, envelopes, and drinking cups. It can even be found on articles of clothing, such as hatbands.¹²
- Fingernail scrapings or swabs from a victim's hands can additionally be used to collect DNA evidence transferred from the suspect, and from the suspect's hands to corroborate digital penetration of the victim's genitals.

The potential for collecting DNA evidence from the victim, suspect, and crime scene is almost unlimited. Moreover, the DNA molecule is long-lived and likely to be detectable for many years in bones or bodily fluids. This means that old cases can now be solved and possibly prosecuted using current forensic technology.¹³

Barriers to Realizing the Potential of DNA Evidence

- Despite the exciting promise of DNA technology, a number of barriers remain to realizing its full potential. One of these barriers is the frequent failure of law enforcement to identify and collect appropriate DNA evidence from the crime scene. Many law enforcement agencies have not been properly trained to recognize and collect potential DNA evidence, and this situation leads to an unnecessary disadvantage for the investigation and prosecution of sexual assault cases. For example, a

¹² Weedn & Hicks, 1997

¹³ Weedn & Hicks, 1997. Investigators need to be trained, however, to re-evaluate old cases and identify any that might benefit from DNA testing.

recent FBI survey revealed that of all sexual assault cases, less than 10 percent had DNA evidence submitted to crime laboratories.¹⁴

Other barriers include the failure to effectively evaluate DNA evidence for analysis, lack of communication between law enforcement and crime lab personnel, limited resources, and the use of incompatible systems for DNA analysis. As summarized in the National Institute of Justice Journal, “despite the abundance of evidence, and despite the advantages of DNA testing, little of this evidence is recovered from crime scenes, less is submitted to crime labs, and still less is analyzed.”¹⁵

Failure to effectively evaluate DNA evidence

When analyzing evidence for DNA, processing a pure sample such as blood or a saliva swab is only a small part of the process. Much of the evidence with DNA potential is not pure but rather collected from the crime scene (from clothing or bedding, etc.). The problem with this type of evidence is that it requires effective evaluation by law enforcement in order to provide information to assist crime lab personnel in their analysis.

- For example, one sheet or shirt collected from a crime scene may contain numerous stains. If the suspect ejaculated on the victim's shirt, this should be noted. Similarly, if the victim states that semen from the suspect can be found at the foot of the bed, the sheet can be oriented to indicate which is the head and foot. All of this information will be useful for crime lab personnel who are screening the evidence.
- Once a stain is detected, moreover, it must be extracted for DNA comparison. This continues to be a time consuming and costly process and any information provided by law enforcement to guide this process is extremely valuable.

Unfortunately, law enforcement has traditionally received very little training in how to evaluate potential evidence in this way. Patrol officers are taught to impound everything they believe might be associated with the crime scene – and this is a good thing given the time sensitive nature of evidence collection. However, this creates a situation in which it is not uncommon to have 10 or more large bags of evidence

14 Weedn & Hicks, 1997

15 Weedn & Hicks, 1997, p.17

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impounded in the property room (e.g., sheets, blankets, sofa cushions, clothing, sexual assault evidence kit).

To make things worse, detectives are rarely taught about the process used by the crime lab to analyze evidence or how different types of crime lab personnel (e.g., those specializing in trace evidence, latent prints, or biological evidence) might be assigned to a case.

- As previously stated, trace evidence includes items such as hairs, fibers, paint chips, glass shards, shoe prints, gun shot residue, arson/explosives and physical matches.
- In contrast, forensic biology (a separate unit within many crime laboratories) will analyze DNA from blood, semen, saliva, fingernail scrapings, etc.

Given this lack of understanding, it is common for detectives to submit a lab request to "analyze all evidence for trace and semen." Neither detectives nor their supervisors typically understand the process set in motion as a result of this request.

Lack of communication between law enforcement and crime laboratory

Just as police officers often fail to understand how to effectively evaluate evidence for analysis, a traditional lack of communication with crime lab personnel has also limited the contribution of DNA technology. For example, in many communities patrol officers, detectives and prosecutors rarely speak to crime lab personnel. Furthermore, when they do speak they are often unable to understand each other because law enforcement and crime labs speak entirely different languages.

In addition, some have noted that the ease with which DNA evidence can be collected (and in the future, analyzed) will only make it easier to taint or plant such evidence.¹⁶ For this reason, it becomes even more critical for law enforcement and crime lab personnel to appropriately handle and document the chain of custody for all DNA evidence.

Limited resources

In addition to these problems that result primarily from a lack of appropriate training and communication, both law enforcement agencies and crime laboratories suffer from limited resources that further hinder the contribution of DNA technology. This situation is especially pronounced for sexual assault, as these cases typically make up the majority of DNA work performed.

For example, sexual assault investigations account for 70% of the DNA work performed by the crime laboratory in San Diego. Another 10% comes from homicide and 20% from the rest of the department (e.g., domestic violence, crimes against persons, and child abuse). This situation is typical of other agencies around the country and suggests that any limitations of DNA technology will disproportionately affect sexual assault cases.

As a result of limited resources, recovered DNA is tested in only 6% of the 250,000 sexual assault cases investigated nationally, leaving a backlog of over two hundred thousand cases awaiting processing.¹⁷

- This reality often comes as a surprise to officers and others, especially given the recent emphasis on offender databases resulting from Megan's law and other developments.
- In particular, rape crisis advocates, victim rights groups, and medical personnel are often shocked to realize how few sexual assault cases are actually analyzed for forensic evidence.

Those working in the field of sexual assault recognize how difficult it is for a victim to go through the process of a forensic examination. Given the difficulty of the process for victims and the cost of the forensic examination (typically ranging from \$200 to \$700), it is a tragedy that most evidence collected in sexual assault cases is never analyzed.

16 Burns & Smith, 1999

17 Weedn & Hicks, 1997

A common scenario for sexual assault evidence is this. Given limited resources, only a small number of cases can be analyzed for DNA. Cases are therefore assigned to the crime laboratory only when a court date is approaching. Sometimes, this means that the case might not even be analyzed before the scheduled trial date, resulting in complaints by defense attorneys and judges. Detectives, prosecutors and victims are left frustrated as the entire process derails. Meanwhile, freezers in the property room continue to fill with sexual assault evidence collection kits. The department may even buy more freezers, although many of the kits are thrown out after the statute of limitations expires. Most have never been analyzed. This scenario is reality all over the country.

Use of incompatible systems for DNA analysis

To further complicate matters, even when evidence is appropriately collected, screened, and analyzed for DNA it can be limited in its contribution by the use of incompatible systems. Forensic laboratories across the country have used different DNA testing systems, including DQA1, Polymarker, RFLP, PCR, and STR. Labs will sometimes even utilize one analytic system for crime scene evidence and another for the suspect's reference standard. Results are therefore frequently found to be incompatible with each other and/or with the state databanks or CODIS.¹⁸

- To briefly summarize some of the different analyses for DNA evidence, RFLP stands for Restriction Fragment Length Polymorphism. The advantage of RFLP analysis is that it is informationally rich, but it takes a large quantity of specimen to conduct and about six weeks to process. For these reasons, RFLP testing will likely be supplanted by PCR analysis.¹⁹
- PCR stands for Polymerase Chain Reaction, an analysis which takes only days to perform and can be conducted with a smaller quantity or poorer quality of specimen. PCR produces much less information, however, in comparison with traditional RFLP analysis.
- More recently, STR (Short Tandem Repeats) technology has been developed which can produce as much as information as RFLP tests. More importantly, current STR marker sets can be

¹⁸ CODIS stands for the Combined DNA Index System, a national investigative support database developed by the FBI.

¹⁹ Weedn & Hicks, 1997

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conducted with small and/or degraded DNA specimens, and the analysis also takes only days to complete.²⁰

²⁰ Weedn & Hicks, 1997

The future of DNA testing

“Developments that will further automate DNA analysis are being developed as an outgrowth of the Human Genome Project. These include robots, microchip-based instrumentation, and mass spectrometry. The run time of such instruments may be only minutes or even seconds. Performance of 100 STR analyses within an hour using an automated mass spectrometer has been demonstrated in a research setting. Support for development of microchip and mass spectrometric work in forensic DNA testing is being provided by the National Institute of Justice. Today, the resulting systems are in operation in only a few research centers, but are likely to become commercially available in the next few years” (Woods & Hicks, 1997, p. 20)

Although technology is improving, processing DNA evidence remains a time consuming and costly part of sexual assault investigation. As a result, it is imperative that patrol officers, detectives and prosecutors understand what evidence should be collected and examined, based on the history of the assault and how DNA results may affect the outcome of the investigation.

Overcoming the Barriers

Thanks to the development of new methods of analysis, the ability of crime labs to process DNA evidence within a reasonable time is expected to improve substantially within the next few years. Regardless, forensic laboratories must have sufficient resources to analyze the evidence submitted and law enforcement must learn to use these precious resources wisely. To accomplish this task, it is recommended that agencies review their policies regarding lab service requests, and make any necessary refinements in direct consultation with crime lab personnel.

- For example, lab service request forms can be revised to include preliminary information about the case. Using the specific details and history of the sexual assault case being investigated, the form can be revised to help detectives focus on what service is being requested from the crime laboratory and why it is being requested. A sample form for this purpose is included in the supplementary materials, entitled "Preliminary Rape Case Information."

- This kind of form can also be used to provide crime lab personnel with guidance to assist in their screening and analysis -- based on the history of the victim and the nature of the assault. Ultimately, an improved lab service request form can assist both law enforcement and crime lab personnel with determining which item(s) will most likely contain potential DNA evidence. A sample of such a service request from crime lab personnel is also provided in the supplementary materials.

Another development that will hopefully assist in overcoming the barriers to DNA potential is the move toward uniformity in analytic techniques. In 1994, the Violent Crime Control and Law Enforcement Act was implemented. Among other things, this Act advocated that uniform standards be used for forensic DNA testing. It further provided federal support for state and local law enforcement agencies to improve their DNA testing capabilities – with the ultimate goal of facilitating their participation in CODIS.²¹

- To establish compatibility among laboratories, the FBI has also promulgated a core set of RFLP and STR loci (specific places in DNA) to be used in forensic analysis.²²

Of course, databases such as these will only be useful when evidence collected from crime scenes is appropriately identified, collected, screened, and analyzed. Specific guidelines to assist in this process follow.

Specific Guidelines for the Sexual Assault Investigator

A number of suggestions have already been offered in this module to assist the sexual assault investigator in making full use of forensic DNA technology. For example, by appropriately collecting and evaluating evidence the investigator can provide much needed guidance to the crime lab personnel for DNA analysis. By improving communication and lab service request forms, law enforcement can more effectively assist the crime laboratory by summarizing details from the specific case to determine which item(s) are most likely to have evidentiary value.

- Obviously, all of these improvements depend on collecting extensive information about the assault history from the victim, as described in the module on victim interviews.

21 Weedn & Hicks, 1997

22 Weedn & Hicks, 1997

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- It will also depend on effective communication with medical personnel who conduct the medical interview and forensic examination (see the module on the forensic exam).

Blood evidence

If blood evidence is collected, the crime lab will need to know whether the victim and/or suspect bled during the assault. If so, it is also necessary to determine which areas of the body produced blood and whether the victim was menstruating at the time of the assault. Finally, the crime lab will need to know whether the victim or suspect received a recent blood transfusion (i.e., in the last 90 days) that might interfere with the DNA results.²³

Clothing evidence

The investigator will also need to determine whether clothing was collected from the scene and whether it was worn during or after the assault. In most cases, all or part of the victim's clothing is removed during a sexual assault. This clothing should therefore be identified as it could contain preejaculate fluids, saliva stains, or trace evidence.

- After the assault, clothing is often used by the suspect and/or victim to wipe the genitals following a sex act. It is critical to identify and collect this clothing, along with any that is put on after the assault – especially those pieces of clothing worn closest to the genital structures.
- Most officers are not taught to identify this clothing separately, but this information is crucial for the crime lab when screening a large amount of evidence.

Basically, all of this information collected from the victim and passed along to the crime laboratory can help to determine which item(s) of clothing will most likely contain seminal fluids, saliva, or other evidence with DNA potential.

Bedding evidence

²³ Medical protocol dictates the color tops of blood vials based on the type of preservatives needed for specific types of laboratory analysis and tests performed using the samples within. Yellow top tubes were generally used for serology and have been supplanted by purple top tubes (containing EDTA) used for DNA testing. Grey top tubes are used for blood alcohol/toxicology testing.

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If bedding is collected, similar questions must be asked of the victim to determine which item(s) will most likely have seminal fluid or other evidence with DNA potential. Throughout this

process it is important to remember that the purpose of these questions is to reduce the demands on crime lab personnel to screen large amounts of evidence.

- For example, if the assault occurred in the suspect's bed, the presence of his own seminal fluid will be irrelevant to the case under investigation. However, the presence of the victim's epithelial cells would at least place her in the suspect's bed in the case of a denial.
- If the assault took place in the victim's bed, every effort must be made to identify stains as relevant versus irrelevant to the assault. For example, if the victim previously had consensual intercourse in the bed, these stains must be identified as resulting from the prior partner(s).

If the victim and suspect engaged in consensual sex in the same bed prior to the assault, any analysis for semen or the victim's epithelial cells would be a waste of valuable crime laboratory resources.

Collecting reference standards

One often overlooked reality about DNA evidence is that it is only meaningful when considered in the context of reference standards.

- For example, DNA evidence collected from the victim's body can only be identified as the suspect's if a reference sample has been obtained from the suspect.
- Similarly, semen recovered on the victim's body or bedsheets can only be identified if reference standards are collected -- not only from the suspect but also from any previous consenting partners whose semen could still be present.

As a result, detectives need to ask the sexual assault victim if she had consensual sex within 96 hours (4 days) prior to the time the biological samples are collected. When clothing or bedding are collected, the detective must also determine if seminal fluid stains might be present from previous consensual partners. In either case, reference samples must be collected from all consensual partners whose semen or other DNA evidence might still be present. This should be done before submitting a DNA request to the crime laboratory.

In cases involving more than one suspect or cases where consenting partners must be eliminated, all reference samples should be submitted for analysis at the same time. The property tag numbers of evidence and reference standards should also be readily available. A copy of the crime report and follow-up investigation should be included with the lab service request in these cases, to address additional questions that crime lab personnel may have. This procedure allows the crime laboratory to complete their work much more efficiently, allowing more cases to be screened and typed.

Types of reference standards

Blood and saliva are the most common source of reference standards for DNA testing. Thus, samples from the suspect can be collected either through a forensic examination by medical personnel or with mouth (buccal) swabs that can be obtained in the field by law enforcement.

- Mouth swabs are becoming increasingly common in sexual assault investigation, both because they are easy to obtain and because many suspects will readily consent to cooperation.
- Mouth swabs are also non-intrusive, as they do not require transporting the suspect to a medical facility or sticking a needle in his arm.

However, the increasing popularity of this technique requires that both patrol officers and detectives be trained to carry the appropriate equipment and properly obtain samples for DNA testing. The equipment and procedures for obtaining mouth (buccal) swabs are described in Appendix B.

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Coming your way: Field testing of DNA evidence

“Steps are now underway to realize the potential of field testing DNA evidence. Recently, a truly portable microchip-based prototype field-testing instrument has been developed. The instrument, which produces findings within 30 minutes, is currently being upgraded and made available commercially. The National Institute of Justice is sponsoring the developments of other types of portable field instruments” (Weedn & Hicks, 1997, p.20)

Submitting the lab service request

Once the preliminary rape case information has been completed and reference samples collected, the detective is ready to submit the lab service request. When doing so, successful sexual assault investigators must prioritize those items of evidence that should be analyzed for trace or biology depending on the type of investigation and the history of the assault obtained from the victim.

- The item listed should be specific to provide the most effective guidance to crime laboratory.
- For example, detectives should request that the “victim’s pink underpants” or “vaginal swabs” be analyzed, rather than the “victim’s clothing” or “rape kit.”

Obtaining supervisory approval

In addition to improving communication with crime lab personnel and revising the forms used for requesting lab services, it is also recommended that supervisors review the lab service requests completed by sexual assault investigators. This secondary review allows supervisors to make sure that only legitimate requests are being submitted, in addition to tracking the number of requests submitted to the crime laboratory. Once this review process is in place, the supervisor(s) can then meet regularly with sex crimes investigators and the DNA Section manager, in order to discuss and prioritize current work in progress, new requests, and any upcoming court dates.

Collecting fetal tissue evidence

Some sexual assaults result in pregnancy, especially those involving adolescent victims. In these cases it may be necessary to collect DNA evidence from the infant if it is carried to full term, or from the fetus if it is not.

- If the victim elects to carry the fetus to full term, a mouth swab or blood sample can easily be obtained from the infant once it is born. Mouth swabs are preferred for this purpose as they are less traumatic for the infant and require no specialized medical assistance.
- However, if the victim elects to abort the fetus, the investigator must immediately work to facilitate collection of valuable DNA evidence.

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Depending on the facility chosen to perform the abortion and the number of weeks pregnant, investigators will encounter a variety of responses from medical facilities when attempting to

collect fetal tissue samples. Jurisdictions will also vary in whether they require an investigator to have consent or a search warrant before fetal tissue can be collected.

- It is critical that investigators alert the medical facility to not add any fixative or preservative such as formalin, formaldehyde, or any other liquid.

Other guidelines for conducting fetal tissue collection are provided in Appendix C.

Collection, packaging, and storage of DNA evidence

Obviously, DNA evidence can only be useful to sexual assault investigators if it has been appropriately collected, packaged, and stored. DNA is usually collected from crime scenes in the form of fresh blood or dried blood, fresh liquid semen or dried stains.

- Depending on an agency's resources, these specimens are identified and collected either by patrol officers or crime lab personnel. In some cases, an investigator might be required to conduct evidence collection at the scene of a crime.
- Wherever possible it is encouraged that crime scene processing be conducted by forensic specialists, as they have specialized training and experience as well as access to equipment such as an alternate light source that can be used to detect potential DNA evidence.

Specific guidelines for collecting, packaging, and storing DNA evidence are provided in the Appendix A. Officers are reminded, however, that the entire item containing the stain should be collected wherever possible (e.g., bedding, clothing, mattress, sofa cushion or car seat) to facilitate processing by the crime laboratory.

Conclusions and Future Directions

To conclude, a number of barriers exist that limit the contribution of DNA technology to sexual assault investigations. Given limited resources it thus makes sense for investigators to work smart, using existing resources most efficiently. This means that DNA analysis should currently be conducted only when necessary to establish an element of the offense – primarily for identification but perhaps also to prove sexual contact when it is denied by the suspect.

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- In the future, however -- as technology improves and the costs associated with DNA analysis decrease -- it will be advisable to conduct DNA analysis even in cases where consent is the

primary issue. In these cases, DNA evidence may not be particularly useful in challenging the consent defense but it could prove invaluable in linking the suspect to prior (or future) unsolved cases.

- Misdemeanor cases (e.g., peeping, indecent exposure) should also be analyzed for the same reason. In fact, there is at least one case of a sexual assault perpetrator being identified solely on the basis of DNA evidence collected at another crime scene in which a misdemeanor case was being investigated.

The importance of this need is best illustrated by the research of Ann Burgess and colleagues, in which 41 serial rapists were interviewed. Taken in combination, these men admitted to having committed 837 rapes and 401 attempted rapes. The critical finding, however, was that each admitted that their earliest victims were younger siblings, neighborhood children, girlfriends, spouses, and other acquaintances.

- This clearly indicates the need to analyze potential DNA crime scene evidence in all cases since a perpetrator's behavior will often cross over from acquaintances to strangers and escalate (Burgess et al., ???).

Of course, any advances in the use of DNA technology will require improvements in the status of databanking, as described in Appendix D and supplemental materials. However, it will also include improved training of law enforcement and increased communication with crime lab personnel. It is hoped that this manual can provide one important step toward strengthening this link and fulfilling “the unrealized potential of DNA testing.”²⁴

²⁴ Title of an article written by Weedn & Hicks, 1997

Future questions for forensic DNA

“There are many issues to be explored in this area. The criminal justice community needs to know what tools will be available in the future to law enforcement officers working crime scenes. Will they be equipped with portable units that they can take to crime scenes to conduct on-scene DNA analysis? If so, will they be able to connect directly from the crime scene to the CODIS database? Will a technology be developed in the near term that permits creating a phenotypic description of a perpetrator based on a DNA sample taken at a crime scene? (A phenotype refers to the physical appearance or functional expression of a particular trait found encoded in the genes.) And as the ability to generate results from ever smaller DNA samples increases, there must be a way to distinguish between samples likely to identify the perpetrator and those likely to mislead investigators” (Asplen, 1999, p.23).

Appendix A: Guidelines for Collecting, Packaging, and Storing DNA Evidence

Collecting and Packaging DNA Evidence

1. Use clean latex gloves for collecting each item of evidence. It is recommended to change gloves between the handling of different items of evidence.
2. Each item of evidence must be packaged separately.
3. Blood stains, semen stains, and other types of stains must be thoroughly air-dried and packaged in sealed paper envelopes or paper bags. To dry stains, a hair dryer can be used on the coolest setting. For large amounts of liquid, a fan can be used.
4. Increasingly, condoms are part of the sexual assault crime scene. Used condoms should be collected and placed in a sterile tube. The tube should then be frozen until analyzed. If a sterile tube is not readily available, officers should make sure – at a minimum – that the condom is allowed to air dry before packaging. Several layers of paper bags can then be used for packaging.

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5. For proper chain of custody, all packages must be marked with the case number, item number, and date. Packages must also be initialed across the seals.
6. If stains must be transferred from an unmovable surface (such as a window or sidewalk), sterile cotton swabs and distilled water may be used.
 - A. Photograph the surface with a ruler before swabbing. Lightly moisten the swab with distilled water.
 - B. Rub the stained area with the moist swab until all of the stain is transferred to the swab. If one swab is insufficient to collect all the stain, use additional moist swabs to collect all of the stain.
 - C. Two additional swabs should be collected as substrate controls for DNA tests. Swab #1 should be moistened and used on an unstained area adjacent to the stained area. Swab #2 should be provided with nothing else on it but the water used in the collection process.

- D. Prepare properly marked envelopes or paper containers for the swabs.
 - E. Air dry the swabs without permitting them to touch one another. If time requires, the swabs may be placed still moist in paper envelopes. (Glass or plastic containers should never be used. Paper containers allow moisture to escape which helps to prevent bacterial degradation of the DNA.)
 - F. Place swabs in appropriate separate paper containers, properly marked for identification.
 - G. Scraping dried stains instead of swabbing should only be done if the surface is perfectly smooth and the scraping will result in almost no loss of material. For example, a stain on a smooth vertical surface can be collected (after photographing with a ruler in the picture) by folding a clean sheet of paper in half and taping the top edge of the paper to the surface directly beneath the stain. With a sterile scalpel blade or unused single-edged razor blade, the stain can be scraped into the fold in the paper. Then carefully remove the paper from the surface, remove the tape, fold the paper into a packet, seal with evidence tape and initial properly.
7. Evidence which is incapable of drying such as pieces of tissue, organ, bone, liquid urine, vomit, or other biological material should be packaged separately in an air tight container. The container should be sealed and properly marked for identification, then immediately frozen and kept stored until analysis. Formalin or formaldehyde should never be used to preserve any biological evidence because these chemicals degrade DNA.
 8. Known standard blood samples from deceased individuals should be transferred by syringe into a purple top tube. They should then be packaged, stored, and shipped using the same procedures as known standard blood samples from a living person, as described below.
 9. Known standard blood samples from living persons should be drawn in purple top tubes, properly marked for identification, placed in a paper container, sealed with evidence tape for proper chain of custody, and stored refrigerated until analysis. If needed, additional packaging should be used for protection from breakage during shipment.

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10. Known standard blood samples (either liquid or dried stains) from persons diagnosed with HIV or hepatitis should be shipped in special containers clearly marked on the exterior that they contain HIV or Hepatitis infected blood.

Storing DNA Evidence

1. Most biological evidence is preserved best when stored dry and cold because dryness and lowered temperatures reduce the rate of bacterial degradation of DNA evidence. With the exception of liquid whole blood samples, the colder the storage the better.
2. For dried stains, material should be frozen (-20 degrees C) or refrigerated (4 degrees C) in separate paper containers. Dried stains which are very old and have been stored at room temperature for months or years will obviously not be hurt significantly by additional short-term storage at room temperature. Nevertheless, it is recommended that these samples be stored cold until they can be analyzed.
3. For undried tissue such as bone, liquid urine, or other undryable biological material (except blood standards), these samples should be kept frozen (-20 degrees C) in separate air tight containers. Glass containers should be avoided as they can break when frozen. Formalin or formaldehyde should never be used for storage as they degrade DNA.
4. For liquid blood standards, these samples should be kept refrigerated (4 degrees C) in their original glass tubes. They should not be frozen.

Shipping DNA Evidence

1. All samples should be hand carried on a business day or shipped by priority overnight courier service on a business day, but never shipped over a weekend or holiday.
2. All shipments should be accompanied by a case submission letter attached to the outside of the package, addressed to the attention of the forensic laboratory.
3. Dried stains should be packaged separately and shipped in a sealed box or sealed envelope at room temperature by priority overnight courier service. It is preferred to ship only the stained portion of clothing rather than the entire garment. The suspected stain should be clearly marked.

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4. Undried tissue: To avoid putrefaction during shipping, tissue, organ, bone, and liquid urine samples (in plastic tubes) should be shipped by priority overnight courier service in a sealed plastic container placed on abundant dry ice in styrofoam containers.

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5. All liquid known whole blood standards should be packaged separately in styrofoam tube packages or wrapped individually in bubble wrap and secured with tape. The individually wrapped tubes of blood should be placed in a cardboard box surrounded by styrofoam chips for protection from breakage. Liquid known whole blood samples should be shipped at room temperature by priority overnight courier. Liquid blood should never be shipped on dry ice because the glass tubes will break.
6. Blood standards from persons diagnosed with HIV or hepatitis should be shipped using a Class 6.2/95 CAN/8-2SAF-T-PAK container with the proper Federal Express shipping tag for dangerous goods. Blood standards should be shipped at room temperature by priority overnight courier service.

Some packaging suppliers for the Class 6.2 substances including blood infected with HIV or hepatitis are listed below:

- * Source Packaging (sells SAF-T-PAK and offers 6.2 specialty training) (401) 738-7733
- * Federal Industries (sells SAF-T-PAK) (800) 523-9033
- * Labelmaster (3M pack and others) (800) 621-5800
- * All Pak (800) 245-2283

Appendix B: Materials and Procedures for Conducting an Effective Mouth Swab

Mouth Swab Collection Kits should contain:

- (1) one plastic tube with two cotton tip swabs
- (1) one manila envelope with an information label
- (1) one slightly smaller manila envelope
- (1) one evidence seal
- (1) one pair of large latex gloves

Procedures for Conducting a Mouth Swab

1. Put on a pair of latex gloves. Remove the two cotton tipped swabs from the plastic tube. Discard the plastic tube.
2. Place the cotton tipped ends of the two swabs in the subject's mouth. Rub the cotton tipped ends against the inside of the cheek of the mouth while slowly rotating both swabs. Rub against the inside of the cheek for about 30 seconds.
3. Remove the two cotton tipped swabs from the subject's mouth. Place the swabs in the slightly smaller envelope and close the flap. Remove the latex gloves and discard.
4. Place the slightly smaller envelope in the envelope with the white information label. Close the flap and seal the flap with the evidence tape.
5. Fill in the identifying information on the outer envelope.
6. Check the reference mouth swabs into the property room and request that they be stored frozen.

Warnings

1. Do not handle or contaminate the cotton tipped end of the swabs. They should only come in contact with the subject's mouth.

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2. The swabs are not used to collect saliva but rather cells from the lining of the cheek of the mouth. Therefore, the swabs should be rubbed vigorously against the inside of the cheek.

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3. Make sure to rotate the swabs in the subject's mouth so that the entire cotton surface of the swab is used for collection.

Appendix C: Guidelines for Conducting Fetal Tissue Collection

Investigators must alert the medical facility to not add any fixative or preservative such as formalin, formaldehyde, or any other liquid. This is contrary to medical training, since formaldehyde is used to preserve tissue. However, its use will destroy DNA.

Collection kits should be made in advance and they should contain:

- (1) one sterile 50cc screw-cap centrifuge tube
- (3) three labels for centrifuge tube
- (1) one permanent marker (Ultra fine point)
- (1) one plastic bag
- (1) one security seal
- (1) one 12" x 15" envelope
- (1) one small cooler (if needed)

Procedures for Collecting Fetal Tissue

1. Have the physician collect 3-5 cc of fetal tissue and place within the sterile screw-cap 50 cc centrifuge tube. (If fetal tissue cannot confidently be isolated, placental remains may be submitted.) Label the tube with the name of the mother, date, and time.
2. Have the physician place the centrifuge tube with the collected fetal tissue in a ziploc plastic bag and put it on ice in a small cooler. The physician should then complete documentation for chain of custody before handing the evidence over to the investigator.
3. Transport the specimen and the completed paperwork to a genetics laboratory immediately. If this is not possible, the specimen should be frozen until arrangements can be made to transport.
4. Heat can destroy DNA. Therefore, if the evidence cannot be immediately frozen, it should be refrigerated. Do not store fetal tissue at room temperature. (Many law enforcement agencies use temporary storage bins over the weekend when their property rooms are closed, however, arrangements should be made to prevent this from happening.)
5. To transfer the specimen to a state laboratory or a contract laboratory, it should be kept frozen (at -20 degrees or colder) until it can be shipped. Place the tube of fetal tissue in a styrofoam shipping box and surround the tube in dry ice. Fill the styrofoam container with dry ice to the top of the inner chamber. Seal the styrofoam box with plastic mailing tape. Place the sealed styrofoam box in a cardboard box and seal with plastic mailing tape.

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A purple top blood vial should also be obtained from the parents. In the case of a statutory rape involving an uncooperative victim, testing can proceed without the mother's reference standard if necessary. The blood tubes must be shipped separately from the fetal tissue. They may be shipped at room temperature in a standard styrofoam blood tube mailer by priority overnight carrier.

Appendix D: The Status of Databanking

The following is excerpted from: V.W. Weedn & J.W. Hicks (1997, December). The unrealized potential of DNA testing. National Institute of Justice Journal, p.16-23.

Today almost all states have legislation related to DNA databanking, most of it focusing on collecting and testing DNA from individuals convicted of sexual assaults and often homicides. In some cases the legislation requires collection from all convicted felons. Although DNA databanking was proposed almost 10 years ago, and although databanking has been almost universally adopted at the state level, the concept of its development in this country is still rudimentary.

The limitations are partly due to the definition of offender categories in the legislation. For example, rapists who plead to a lesser offense not covered by a particular state databanking law are therefore not subject to it. Similarly, in some states DNA collection laws are inapplicable to juveniles involved in the criminal justice system. In other instances DNA is not collected until an offender is released, instead of at intake, making it impossible to match the offender's DNA to that in a case opened during incarceration. Other problems stem from lack of funding and the incompatibility of the states' genetic testing systems. Of the 47 states that have passed legislation, the program is operational in only 36, and of that number most programs are severely backlogged.

The CODIS System

The CODIS system (COmbined DNA Index System) is a national investigative support database. Developed by the FBI, it is used in the national (NDIS), State (SDIS), and local (LDIS) DNA Index System networks to link the typing results from unsolved crime cases in multiple jurisdictions or to those convicted of offenses specified in the DNA databanking laws passed in 47 states. By alerting investigators to similarities among unsolved crimes, CODIS can aid in apprehending perpetrators who commit a series of crimes and in this way prevent other offenses by the same person. The 77 laboratories in the 36 states participating in CODIS have produced 126 case-to-case "hits" and 76 case-to-offender "hits."

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