WHAT IMPACT WILL DNA DATABASES HAVE ON CRIME SCENE INVESTIGATION IN A MID-SIZED LAW ENFORCEMENT AGENCY BY 2008?

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This Command College project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is not to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future: creating it, constraining it, and adapting to it. A futures study points the way.

The views and conclusions expressed in this Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (P.O.S.T.).

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CHAPTER ONE

INTRODUCTION

Issue Identification

This project was undertaken as part of the California Peace Officers Command College course, sponsored by the California Commission on Peace Officers Standards and Training. The project serves as a vehicle to examine the issue of DNA Databases and the impact they will have on crime scene investigation in a mid-sized law enforcement agency in California by 2008.

Federal and state legislation has been changing to expand the architecture of DNA databases. As these databases have grown, the manner in which law enforcement conducts crime scene investigation is also changing. Cold cases involving criminal investigations, which have gone unsolved for years, are now gaining new life through the reexamination of forensic evidence that contains DNA. As DNA databases expand, the number of cases having suspect leads through DNA evidence collection matches should also increase.

The Combined DNA Index System (CODIS) is an electronic database of DNA profiles that can identify suspects. It is similar to the Automated Fingerprint Identification System (AFIS) database used for fingerprint identification. Just as fingerprints found at a crime scene can be run through AFIS in search for a suspect

whose prints have been entered into the system or prints found at another crime scene, DNA profiles can be entered into CODIS.

Deoxyribonucleic acid (DNA) is the fundamental building block for an individual's entire genetic makeup. DNA is contained in virtually every cell in the human body and can be found in blood, semen, skin cells, tissue, organs, muscle, brain cells, bone, teeth, hair, saliva, mucus, perspiration, fingernails, urine, and feces. A person's DNA is the same in every cell. With the exception of identical twins, one person's DNA is different from every other individual's.[1]

Recent advancements in DNA technology are enabling investigators to solve cases involving known suspects. Investigators are able to take a DNA sample from a suspect and compare it with forensic evidence taken from the scene. This has been done for years now, similar to comparing fingerprints at the scene with the suspect. What is changing now is law enforcement's ability to collect DNA at crime scenes and identify suspects by comparing that evidence with DNA databases that contain profiles from convicted criminals and other DNA found at other crime scenes. Because DNA is so unique, DNA colleted from a crime scene can either link a suspect to the forensic evidence or eliminate a suspect. Even if there are no suspects, DNA found at one crime scene can be linked to DNA found at a different crime scene.

Valuable DNA is being found on evidence that has been held in property rooms for years. All homicide and rapes cases are being reexamined in light of the new advances in DNA technology and increasing databases. However, several factors can affect DNA left at a crime scene or stored in evidence lockers and containers. As

discoveries are made on how heat, sunlight, moisture, bacteria, mold, and other contaminates affect the way we have collected and stored DNA evidence, changes are being made.

Another key issue is the changing nature of DNA databases. CODIS began as a pilot project in 1990 by serving 14 state and local laboratories. The DNA Identification Act of 1994 formalized the FBI's authority to establish a national DNA index for law enforcement purposes. CODIS, which became operational in 1998, is an automated DNA information processing and telecommunications system that supports the National DNA Index System, state DNA Index System, and local DNA Index System.[2] The CODIS architecture is expanding as local laboratories go on line and begin to input and access the database.

All 50 states enacted DNA database legislation to include all persons convicted of felony sex offenses. Other crimes may be included for profile sample inclusion in CODIS, but this is based on the individual state's legislative requirements. The CODIS database will obviously increase as state law changes to include more profile samples.

CODIS blends forensic science and computer technology into an effective tool for solving crime. CODIS enables federal, state, and local crime labs to exchange and compare DNA profiles. As databases increase with offender profiles and forensic profiles from crime scenes, there will be a need for mid-sized law enforcement agencies to change the manner in which they conduct crime scene investigation. The amount of DNA evidence and the backlog of profiles to be entered into CODIS, will force law enforcement managers to reallocate resources to meet the increased needs. By

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[1] Fisher, Barry A., *Techniques of Crime Scene Investigation* (Boca Raton, Florida: CRC Press, 2000), p.

collecting forensic DNA evidence and processing it in a more efficient manner, cases will be solved and criminals will be brought to justice.

Historical Review

Blood typing, designated by A, B, AB, and O, was the first genetic marker that was used for human identification at the turn of the 20th century. By 1925, it was discovered that the mode of inheritance was inferred from the population frequencies of the four blood-type groups. [3] From 1925 to 1985, tremendous advances were made in the field of forensic identification of biological substances. Serum proteins and enzymes were identified and used in paternity cases, but never rose to the certainty of a higher standard needed in criminal cases.

In England, in 1985, Alec Jeffreys demonstrated the use of DNA in criminal cases by comparing variable length segments of DNA to exonerate a falsely accused subject in two rape/homicide cases. This "genetic fingerprinting" [4] procedure was then implemented by the FBI in 1988.

Each individual is made up of hundreds of millions of microscopic cells. These cells come in various shapes and sizes with the inner nucleus being spherical. The nucleus contains a number of wormlike microscopic bodies called chromosomes and every cell in the body has an identical 46-chromosome makeup in its nucleus. Twenty-three chromosomes that come from the sperm (father) and 23 from the embryo (mother)

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[2] U.S. Department of Justice, *The F.B.I.'s DNA & Databasing Initiatives*, 2000.

[3] National Institute of Justice, *The Future of Forensic DNA Testing*, 2000.

[4] National Research Council, DNA Technology in Forensic Science, 1992, p. 28

make up the genetic formation of an individual.[5] It should also be noted that not all cells, for instance red blood cells, have a nucleus and therefore no chromosomes. There are a thousand or more mitochondria outside the nucleus of a cell. Mitochondria are transmitted only from the embryo, or egg, from the person's mother, not from the sperm of the father.

At the core of each chromosome is a very long thin thread of deoxyribonucleic acid. This is where the acronym DNA is from. The DNA molecule in a chromosome is a double-threaded, long-coiled helix. There are four bases abbreviated by the letters A, T, G, and C. A always pairs with T and G always pairs with C.[6] What makes everyone unique is the sequence in which these pairs occur along the strand, or stair steps, of the DNA. The DNA molecule is super-coiled and compacted, measuring an inch or more in length; yet a single human chromosome, as seen under a microscope, is about 1/5000-inch long.

An embryo and sperm each contain 3 billion base pairs. The set of base pairs, a total of 6 billion, are called the genome. The differences in the sequential order of base pairs are what make each person's DNA unique. With exception of identical twins, no two people are genetically alike. A genotype for the group of specific positions, or *locus*, is commonly referred to in forensic analysis as a profile. The loci that have most extensively used for forensics are regions of short segments of DNA repeated tandemly many times. This is measured by which various sizes of DNA are compared, which is called a restriction fragment length polymorphism (RFLP). The variable number of tandem repeats (VNTRs), a type of RFLP, are DNA sequences of a length of 8 to 80

[5] James W. Osterburg and Richard H. Ward, *Criminal Investigation*, Cincinnati, OH: Anderson Publishing,

pairs that are repeated in different numbers of times.[7] One of the limitations of VNTR is that a relatively large amount of high quality DNA is required for a profile, and the process is very time consuming.

Between 1985 and 1995, a new process was introduced and perfected that became the universal industry standard. This is the polymerase chain reaction (PCR)[8] that amplifies a tiny amount of DNA, thus enabling the possible identification of very tiny amounts of DNA often left behind at crime scenes. Due to PCR, minute amounts of DNA found in cigarette butts, postage stamps, hats, sweat from shirts, saliva from drinking glasses, and similar sources can be successfully analyzed. The discovery of this technique has revolutionized cold case follow-up and current crime scene investigation techniques.

A new typing procedure called "short tandem repeats", STRs, uses the PCR process to analyze DNA.[9] It has the ability to provide a profile on a very small piece of evidence. As has already been mentioned, mitochondrial DNA analysis allows law enforcement to obtain information from old items of evidence as well as small pieces of evidence containing little biological material.

In 1990, CODIS began as a pilot program that grew to a national DNA index for law enforcement that became operational in 1998. With the formation of the National Missing Persons DNA Database Program, funded by Congress in 1999, collection of

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2000, p. 90

[6] National Institute of Justice, *The Future of Forensic DNA Testing*, 2000.

[7] National Institute of Justice, *The Future of Forensic DNA Testing*, 2000.

[8] Fisher, Barry A., *Techniques of Crime Scene Investigation* (Boca Raton, Florida: CRC Press, 2000), p. 233

[9] James W. Osterburg and Richard H. Ward, *Criminal Investigation*, Cincinnati, OH: Anderson Publishing, 2000, p. 90

mitochondrial DNA samples from maternal relatives of missing persons were added to the CODIS system.

In 2001, the federal convicted offender program was initiated using nuclear DNA profiles from convicted felons, adding them to the CODIS system. These profiles are now available to compare against mitochondrial DNA samples found at the scene of various crimes. With this new DNA technology, the forensic index system is used to compare DNA found at crime scenes and links it together, even when there are no known suspects. Matches made between the systems contained within CODIS are sent to qualified DNA analysts responsible for validation or to refute the match. Follow-up with case investigators can then result in other leads, and ultimately the arrest of the suspect.

The National Commission on the Future of DNA Evidence was established by the attorney general to maximize the value of forensic DNA evidence in the criminal justice system. Janet Reno, after reading the article, Convicted by Juries, Exonerated by Science: Case Studies In the Use of DNA Evidence to Establish Innocence After Trial, directed the National Institute of Justice to establish a commission. The first commission meeting was held in 1998 and made specific recommendations to the Attorney General concerning five specific areas.

1. The use of DNA in post-conviction relief cases
2. Legal concerns and the scope of discovery in DNA cases

3. Criteria for training and technical assistance for criminal justice professionals involved in the identification, collection and preservation of DNA evidence at the crime scene
4. Essential laboratory capabilities in the face of emerging technologies
5. The impact of future technological developments on the use of DNA in the criminal justice system. Prominent professionals reported back to the commission on each topic, writing published pamphlets and reports.

Assistant United States Attorney Dennis D. Bauer, who worked as a group member and wrote Chapter 4 of the published report titled "Post-conviction DNA Testing: Recommendation for handling requests", pointed out that England has developed a DNA database that includes all felony convictions including burglars.[10] They have found that the majority of offenders have been convicted of burglary prior to committing more serious offenses. This has made the DNA databases in England more robust than CODIS. He said that the state of Virginia has a similar law mandating the inclusion of DNA samples to CODIS from all convicted felons.

The issue of preservation of evidence and training issues are the two largest priorities according to Bauer. Because DNA evidence must be maintained before, during, and after the trial, storage concerns like space and costs continue to grow. Bauer believes that police should be collecting and profiling DNA on all gang members and that soon the state of California will pass legislation similar to Virginia.

[10] Dennis Bauer, interview by author, Orange, Ca., 16 July 2003.

The working group for the national commission on the future of DNA evidence on crime scene investigation began in 1998. The work group was responsible for the completion of a brochure titled, "*What Every Law Enforcement Officer Should Know About DNA Evidence*." The brochure consists of a brief explanation of what DNA is and what the CODIS system is all about. Other subjects covered in the handout are evidence collection, preservation, identification, contamination, transportation, storage, and location of DNA evidence. A unique feature of the brochure is a "cut-out card" that can be attached to a field officers notebook to be used as a reminder and checklist while at a crime scene.

Work group members were also involved in the published research report from the U.S. Department of Justice titled Crime Scene Investigation, A Guide for Law Enforcement. The authors of the report recognized that the size of the law enforcement agency, availability of resources, and the level of expertise vary greatly. They suggested that smaller agencies seek assistance from other agencies, taking the form of securing additional training, sharing resources, forming partnerships, and seeking additional funding. The transcript from their proceedings can be found on the Internet website of the National Institute of Justice.

Implications of Issue

Many mid-sized law enforcement agencies contract out major crime scene investigation to the local sheriff's department crime lab, an adjoining jurisdiction's lab, or the Department of Justice. Some departments have their own forensic science units, but the ability to conduct DNA typing and analysis is limited to sophisticated crime labs

with trained specialists. After speaking with Russell Baldwin of the Orange County Forensic Science Services, it was clear the crime labs are overwhelmed with evidence waiting to be processed for DNA analysis. There is a common 3-6 month waiting period for evidence processing.[11]

Crime scene technicians and investigators are focusing more and more on the collection of evidence that contains DNA. With that focus comes more evidence and an increase in the number of samples to be included in the CODIS system. As technicians grow in their experience and expertise on collection of DNA evidence, less serious offenses will have DNA-based forensic evidence collected.

The CODIS system is expanding and now includes samples from family members of missing persons. Several states are passing legislation to include a wider variety for criminal offenses for DNA sample inclusion. State DNA databases are being linked with the federal CODIS system, and there is talk about including and sharing on an international basis. With more samples in the system, more positive identifications and crime scene matches will occur.

If changes are not made in how law enforcement conducts crime scene investigation, valuable DNA evidence will not be collected. At the root of the issue is how crime scenes are processed and evidence is collected. DNA databases are going to continue to expand. For law enforcement to take full advantage of this tool for evidence and suspect identification, changes are going to have to be addressed.

In the next chapter, futures forecasting will be addressed by examining trends and events. Experts in the field of DNA databases, forensics, criminal investigation, and

[11] Russell Baldwin, interview by author, Orange, Ca., 8 July 2003.

criminal prosecution will give a glimpse of a probable future. A law student and undergraduate college student will also address civil liberties at issue when the government DNA database is discussed.

CHAPTER TWO

FUTURES FORECASTING

In order to determine the impact DNA databases will have on crime scene investigation in a mid-sized law enforcement agency by 2008, a Nominal Group Technique (NGT) exercise was conducted in July of 2003 to forecast trends and events. An NGT is a non-scientific brainstorming session, facilitating input from a diverse group of people, generating discussion and analysis of ideas that can be used to impact the issue.

Nominal Group Technique

Ten individuals were selected to participate in the process. Participants were selected based on their backgrounds and interest in the issue. Both public and private sector professionals, and college students were utilized to ensure the best possible sampling ideas. The group included a senior deputy district attorney, who specializes in criminal prosecution involving DNA evidence; the forensic supervisor of a sheriff's department crime lab who inputs and uses the CODIS system; a forensic specialist for a mid-sized law enforcement agency; a crime scene investigator; a homicide detective; a homicide detective sergeant; a police captain; a law student; a paralegal; and an undergraduate college student (Appendix A).

Prior to the beginning of the NGT, panelists were provided with materials to aid them in fully understanding the NGT process. These materials included the definitions

of trends, events and cross impact analysis. The NGT process was also discussed. The panel was tasked to answer the following question:

"What impact will DNA databases have on crime scene investigation in a mid-sized law enforcement agency by 2008?" During the NGT session, the involved participants were asked to determine if the trend of DNA databases would impact crime scene investigation.

All panelists were informed that a trend has a past, present and future. It is used to plot or discuss issues that may lead to a consistent activity occurring. They are non-directional in nature and could have either a positive or negative impact on the issue statement.

The panel identified 40 trends (Appendix B) that were likely to have an effect on DNA databases and crime scene investigation. The panel utilized a voting process, taking into consideration the level of importance and expected impact of each trend, to narrow the original 40 trends to the top 5 trends.

In Table 2.1, Trend Summary, the panel rated the likeliness of each trend in the designated time period. The column labeled "-5 years" indicates five years in the past, "Today" indicates what is currently occurring, "+5 Years" indicates the time period five years from now, and "+10 Years" indicates the time period ten years from now or longer. The column labeled "Concern" indicates the level of concern, rated from 1-10, that panel members had reference each trend relative to DNA databases and crime scene investigation. "One" equals very little concern and 10 equals the greatest concern. The table values for each column represent the median of the ranking of all panel members.

Table 2.1 Trend Summary

Trend	-5 years	Today	+5 years	+10 years	Impact
T1. Costs	75	100	152	220	9.8
T2. Evidence Focus on DNA	54	100	158	154	7.8
T3. Training	34	100	173	179	9.8
T4. Security	68	100	146	166	7.6
T5. Non-criminal collection	50	100	158	222	9.5

T1: Cost of using DNA evidence- The panel believed that this trend was less five years ago due to the limited use of DNA evidence. One panel member believed that the costs were greater because of costs for DNA labs and databases. All panel members saw a significant increase in future costs to process crime scenes, collect and store evidence, process scientific evidence collected from crime scenes, and gather DNA samples from convicted felons. It was mentioned that the cost factor for the extraction and collection of DNA samples from current prisoners and convicted felons would probably be going down. They based this belief on the advances in DNA technology and sample collection.

One panel member believed that the overall cost of prosecution would be going down over the next 10 years as expanding DNA databases, crime scene evidence, and increased technology would result in more guilty pleas and plea-bargains. This would result in fewer trials and fast prosecutions.

T2: Evidence Focus on DNA- The scores were very uniform; the group strongly believed that more evidence would be collected and more DNA tests would be utilized in the future. Five years ago, DNA evidence was being used to match known suspects to crime scenes, primarily in sexual assault, rape and homicide cases. A trend has been seen in the examination of cold case evidence that contains DNA. More agencies are examining cold cases that have DNA evidence.

One of the panel members mentioned the use of Short Tandem Repeats (STRs) causing the increase in DNA sample inclusion into the CODIS system and cold case hits. Another member stated that with the trend towards the expansion of the CODIS system, the focus toward DNA evidence collection would increase. There was some discussion about the possible future changes in the law to include DNA profile of convicted felons into the CODIS system.

T3: Training and Specialization of Crime Scene Investigation- Scores seemed to depend on whether or not the panel members were focusing on "where we need to be" versus "where we will be." The members agreed that training and specialization in the collection and analysis of DNA has been lacking in the past five years. Forensic specialists and lab technicians have been doing their best to keep up with the rapid growing technology and discovery relating to DNA science. The average peace officer or civilian crime scene investigator has not been keeping up with current trend and rapid changes. The need for more advanced training and the apparent lack thereof seemed to be the number one trend that would have an impact on the issue statement. The panel opined that during the next five years, law enforcement would see tremendous growth in

the specialization of DNA and training offered to field personnel. They also saw training leveling off after five years.

T4: Security of DNA databases- This trend had the lowest impact score relating to the issue statement. The reason for this is one of the panel members who works directly with the DNA database (CODIS) didn't think it was very likely that a hacker could gain access into CODIS and alter the database. The panel believed that safeguards were in place at the inception of CODIS and that security has improved and will continue to improve over the next 10 years. One panel member stated that it would take a person who understood DNA and profile samples and who had the computer knowledge to hack into the current system to be able to alter the CODIS system.

One panel member expressed her concern over the possible abuse of civil liberties that could take place by the government based upon the misuse of the DNA profile database. There was also discussion on the possibility of insurance companies gaining access to the databases to examine DNA profiles of potential customers. This could be done to determine the propensity of future disease and longevity of life. It could also be used as a screening tool and as a form of discrimination.

T5: Expansion of the DNA Database- The panel members said they have seen an increase in the number of DNA samples, evidence collected, and convicted felon's DNA profiles into the CODIS database. One panel member stated that she believed that by next year, the state of California would pass legislation that would include DNA samples from all subjects convicted of any felony. Some states already have such laws on the books. Panel members also believed that over the next 10 years, DNA samples from people other than criminals would begin to be collected.

There was also discussion that advances being made in technology would enable simplified method of analysis of DNA profiles thus making it more practical to include the entire population. One panel member mentioned missing persons identification as the possible catalyst that would lead to more public approval and political pressure to expand the database to include children. The U.S. Army is currently taking DNA samples for wartime and missing-in-action identification. The panel rated the level of concern as a 9.5 for a mid-sized law enforcement agency. These were seen as positive.

The panel next considered events that could occur and the effect those events would have on a mid-sized law enforcement agency relative to DNA databases.

An event is something that takes place and has an impact on the issue statement, whether good or bad. These are projected incidents that have not yet occurred, which, if they did, would create a response by the organization. Like trends, events can have a positive or negative impact on the issue.

The panel identified 14 events (Appendix C) that were likely to have an impact on a mid-sized law enforcement agency using DNA databases with evidence collected from crime scenes. From the original 14 events, the panel narrowed the number to 5 for the purpose of further evaluation of their impact. This was completed through a voting process by the panel, which took into consideration the level of importance and expected impact of each event.

In Table 2.2, Event Summary, the panel projected the earliest year the event could occur, from the date the panel met. This value is listed in the column entitled Year>0. In the next two columns, +5 Years and +10 Years, the panel determined the probability that each event would actually occur within five years and ten years. In the

last column, Impact (-10 to +10), the panel determined the level of impact they felt the event could have on DNA databases and crime scene investigation in a mid-sized law enforcement agency, with –10 equaling the greatest negative impact and +10 equaling the greatest positive impact. The table values in each column reflect the median of the ranking of all panel members.

Table 2.2 Event Summaries

Event	Year >0	+5 Years	+10 Years	Impact (-10 to +10)
E1. Legislation to include all arrestees in database	1.95	94%	99.8%	+9.4
E2. Legislation Mandating Uniform Database Internationally	9.8	0%	43.5%	+5.7
E3. Wrong ID on High Profile Case	2.3	81%	98%	-6.2
E4. Create a Task Force/Team	5.1	70%	76.5%	+7.8
E5. Local Lab Calls 100% for ID	4.7	66%	81%	+5.5

E1: Legislation to Include All Arrestees in Databases- The panel members all agreed that this event would likely occur in the near future. One panel member was confident that by next year, the state of California would pass legislation to include DNA profiles into the CODIS database on all people convicted of a felony. Other panel members stated that in many other states, all felons are added to the DNA database already. This event was seen as having the most positive impact on the issue statement as compared to the other possible events. It was also seen as the most probable to occur in the next 5 years and almost certain to occur in 10 years.

As other states see the benefits of a broader database, greater frequency of DNA matches on cold case investigation, and more missing persons being identified using DNA, legislation will follow to expand current databases.

E2: Legislation Mandating Uniformed Database Internationally- This event was seen as possibly occurring no sooner than 10 years from now. A couple of panel participants did not believe this event would ever occur. One panelist said that even slower countries will have caught up with technology in 10 years, and at least a representative sample will be involved in the uniform international database. All panelists believe that this event will be positive but the strength of the impact would be debatable as the effect on a mid-sized law enforcement agency would be marginal.

With the awareness of international terrorism and the cooperative efforts of the international community, more countries may be willing to compile DNA samples on known terrorists. Inclusion of forensic DNA evidence recovered at terrorism crime scenes will, without a doubt, be entered into the CODIS system. As this tool becomes more successful, the international community will probably follow the United States.

E3: High Profile Case Involving the Wrong Identification using DNA Databases and Forensic DNA evidence- This event was the only one seen as having a negative impact on the issue statement. It was also seen as very probable to occur in the next 5 years and almost a certainty to occur in the next 10 years. The variation on this event from 1-5 years seemed to deal with what each participant saw as the reason for wrong identification. Some panel members believed that the wrong ID would be caused by human error while others thought the wrong ID would be caused either by purposeful misconduct or by actual problems with the DNA.

Training or the lack thereof could also be a factor. Some discussion occurred in reference to the increased possibility that forensic DNA evidence could be planted at the crime scene in order to frame an uninvolved person. One panel member said that there have already been incidents of convicted felons serving time in prison, giving an object containing their DNA to a visitor to take out and plant at the scene of a crime. This was done in an attempt to claim innocence and a mismatch of DNA evidence on the original conviction.

E4: Creation of a Crime Scene Task Force/Team to Pool Resources- In light of the current economic times in California, most panel members believed a multi-agency task force for collaboration would be necessary for mid-sized law enforcement agencies to be able to process crime scenes containing forensic DNA evidence. One individual believed that there was no chance of a task force being created within the next 5 years, while others were fairly certain, giving it an 80% probability. The task force concept was seen as having a very positive impact on the issue statement but there was no change of the probability between 5 and 10 years.

E5: Local Forensic Labs Willing to Claim 100% Identification in Court- There was some spirited debate surrounding this event. Many jurisdictions have forensic scientists willing to testify in court that a DNA match is a 100% match, similar to finger print identification testimony. The panel member from the local DNA lab stated that it was a policy decision that was made by organizational management. The panel members from the office of the prosecution stated a lack of 100% identification was making it difficult to convince a jury beyond a reasonable doubt.

The group opinions varied greatly on this event based upon personal experiences and inside information. Because of this, the group spanned from “no possibility of the event occurring in the next 5 years” to a high probability that it would eventually occur. The range of impact was also varied. Some members saw no impact at all and some saw a +10 impact, resulting a mid-range score.

Cross Impact Analysis

A Cross Impact Analysis was completed on the trends and events discussed. The Cross Impact Table depicts the severity of the impact that events would have on each trend. Through discussion and debate the panel evaluated the impact, positive or negative, as well as the relative level of impact on a scale of –5 to +5. The panel was directed to consider the impact of social, technological, environmental, economic and political issues. A discussion surrounding the artificial creation of the trends and events was also completed to determine if a desired outcome could be achieved.

Table 2.3 lists the trends across the top, with Trend 1 being designated as T1 and continuing for all 5 trends. The events are listed on the left column with Event 1 being designated as E1 and continuing through E5. The impact each event would have on each trend, either positive or negative, is listed in the table, using the median of all values compiled.

Table 2.3 Cross Impact Table

	T1	T2	T3	T4	T5
E1	+0.11	-1.3	+0.11	-.89	+4.7
E2	-1.4	-.22	-.22	-1.4	+4.9
E3	-1	-1.6	+0.67	+0.22	-.22
E4	+0.22	+1.6	+2.6	0	+1.3
E5	+2.6	0	0	0	+0.67

Legend:

Events:

E1: Legislation to include all arrestees in databases
E2: Legislation mandating uniform databases internationally
E3: Wrong ID on high profile case
E4: Create a task force/team
E5: Local Lab calls 100% for identification in court

Trends:

T1: Costs
T2: Evidence focus on DNA
T3: Training and specialization
T4: Security of databases
T5: Non-criminal collection of DNA samples

The two events that seemed to have the most impact on Trend 5 related to legislation mandating the expansion of the databases, both nationally and internationally. During the discussion of E1 and T1, one panel member gave the impact score a +5, with all other panel members giving it a low impact score. The panelist stated that it was a good investment and will save money in the long run to include all arrestees in the database. The cost at first would be great and have a negative impact, but it would benefit all law enforcement in the long run to have a large DNA database for

identification and forensic purposes. The other trends were relatively unaffected by legislation.

Panel members discussed Event 3, a wrongful ID, having a positive effect on T3, training and specialization. The conversation was centered on previous high profile cases involving DNA evidence in which the jury acquitted the suspect. Specifically the crime lab at LAPD, and the improvements that have been made since the OJ Simpson trial, have both had a positive impact on DNA handling and processing. Better training, higher standards, and more resources were the ultimate outcome.

The creation of a collaborative task force was seen as having a positive impact on almost all trends mentioned with the exception of T4, security of databases. Discussion included the overwhelming number of pieces of evidence containing DNA in which the local crime lab is facing. Giving up control and access to the CODIS system for inclusion and comparison to other labs will eventually have to occur. If not, the local lab now performing this task will need to expand and increase in personnel.

Alternative Scenarios

Three scenarios were created based on information developed through the Nominal Group Technique and research. One scenario is optimistic, in which DNA databases serve a vital role in the identification of a missing child. The second scenario is pessimistic, in which insurance companies hack into the CODIS system to screen prospective clients. The third scenario is normative, or status quo, addressing the issues of obtaining DNA samples from subjects serving time in state prison.

The use of these scenarios is to provide a tool to peer into the future by utilizing the trends and events described by the panel members. These scenarios provide a starting point from which ideas can be included into forecasting what might occur. They are meant to develop further thought on trends and events that could possibly impact DNA databases and crime scene investigation in a mid-sized law enforcement agency.

Scenario #1 – Optimistic

In 2035, everyone has been mandated to provide a sample of DNA to be included into the International DNA database. The database has been a tremendous tool in the reduction of sexual assaults and child abductions, so it was a surprise for the North County CSI task force to get the call to follow-up on the City of Richland's Police Department on a kidnapping call. Crime scene specialist Moyer, who has been working the tack force now for about 5 years, made contact with the mother of the abducted 4 year old. "We'll find your daughter soon," Moyer assures the distraught parent.

"Little Katy was only out of my sight for a minute, then she was gone! " explains Katy's mother Michelle. Michelle reached in her purse and provided Investigator Moyer with Katy's Health Care and Identification card. Moyer took the card from Michelle and scans the DNA barcode imprint found on the back. The hand-held barcode scanner immediately displays Katy's picture on the color monitor. "That's her!" shouts Michelle, "That's my little girl!" Investigator Moyer quickly calls the statewide Identification and Apprehension Unit located in the State Capitol, briefing the on-call supervisor, Lt. Peterson, of his situation.

“This might just be a lost little girl, but we are treating it like an abduction,” explains Moyer. “Are you ready to receive the DNA barcode information on the missing subject?” asks Moyer. Peterson replies by telling Moyer to go ahead and transmit. Now that Lt. Peterson has the DNA barcode information, he activates the statewide missing persons scanning grid system and enters Katy’s DNA barcode information. Lt. Peterson then activates the centrally located barcode scanners throughout the area of the City of Richland.

Immediately there was a hit. Katy’s DNA barcode, an implant placed under the skin, was scanned as the suspect drove through a reading station while traveling on the interstate away from the City of Richland. For the last eight years, all children born in the United States, or who have immigrated into the country, have had to have the DNA barcode implant placed under their skin behind the neck area. With powerful scanners placed throughout the state, missing and abducted children have been recovered with tremendous success.

Lt. Peterson forwards the information to Moyer and transmits over statewide communication of Katy’s location. The GPS coordinates of the vehicle were also recovered from the suspect’s car simultaneously as the barcode was read. Now using GPS, the California Highway Patrol locates the suspect vehicle and rescues Katy. Katy is positively identified using the DNA barcode scanner and returned to her mother. The suspect is also positively identified using the DNA barcode that was implanted in him due to a court order from his last conviction prior to his release from prison.

Scenario #2 – Pessimistic

Ever since federal legislation was passed in 2013, requiring all people to submit their DNA profile to the International DNA database system, there has been wide scale discrimination. Hackers, from underground resources for insurance and health care providers have been gaining access into the database. They have been screening prospective customers prior to issuing coverage. Many people are being denied insurance and health care treatment based upon genetic information.

When prospective customers submit applications for insurance and health care coverage, their DNA sample is found in the database and examined. Based on the sample, propensity for care coverage and possible genetic predisposition to certain terminal disease is evaluated. The insurance company then denies coverage based on negative genetics found from the database.

Because of the misuse and security concerns over the use of DNA databases, public opinion has changed and has grown more negative. People are now saying that government has gone too far and is either abusing their power or not taking enough measures to secure the current wealth of genetic information.

People are now avoiding hospital delivery for their babies. Ever since the law mandated the collection of DNA samples from all newborn infants for inclusion into the DNA database, parents have become more reluctant to cooperate in sample inclusion. Also, due to all the hacking being committed on the system, the evidentiary value of DNA matches are being thrown out of court.

Scenario #3 – Normative

The year is 2005, and the prison population at Folsom State Prison receives yet another opportunity to be cleared of wrongful conviction. The Warden has offered, at no cost to the inmates, to swab a small amount of saliva for DNA typing and inclusion into the federal DNA database called CODIS (Combined DNA Index System). The inmates, who have not been included in the database, can now voluntarily submit their own DNA to be compared with DNA found at the scene of the crime that they were convicted of. The problem is, they know that their DNA will also be compared with the thousands of DNA samples collected from crime scenes throughout the nation. The likelihood of DNA matching them to a crime they had committed, but never been suspected of, is high. All those unsolved crimes could now be traced to them if they submit the DNA sample.

Out of the thousands of inmates, only three come forward and submit to DNA inclusion to the CODIS System. The Warden contacts the state legislature and suggests new state law requiring all convicted felons, not just sex offenders and murderers, to submit to inclusion into the federal DNA database.

Social scientists conduct a study and find that the majority of all convicted rapists and child molesters have had a burglary conviction in the past. State law is passed to mandate the inclusion of DNA profile samples into the CODIS system of all convicted felons, whether or not they were sentenced to state prison.

The CODIS database now includes all felons. Law enforcement agencies will now approach all burglary crime scene investigation with DNA evidence as their primary focus of forensic evidence collection. Arrest and clearance rates relating to burglary will increase.

Summary

The nominal group panel had a good mix of cooperation and conflict. The issue statement was seen from different viewpoints. The members of the panel from the Office of the District Attorney were focused on more effective crime scene investigation to be used for trial and the need for 100% identification by the lab. The member from the crime lab was concerned about contamination of evidence, and safeguards that were needed to keep crime scene investigators from leaving their own DNA at a crime scene.

All the crime scene investigators were interested in more up-to-date training for field personnel. The college students were looking at the issue statement from a civil liberties viewpoint and saw the potential for abuse as a future problem. Law enforcement personnel members focused on suspect identification and evidence evaluation for suspect leads. All panel members recognized the cost factor as a variable that was going to affect their respective future operations.

Technology in the area of DNA is changing rapidly. The criminal justice system can only keep up if it places resources towards this growing field. By limiting specific crimes to be included into the DNA database, law enforcement has been able to keep pace with the need for sample entry from specific crime scenes. Law enforcement couldn't have done it all at once. One needs to climb the ladder, one step at a time.

In the next chapter, a strategic plan will be discussed to insure that crime scene investigation in a mid-sized law enforcement agency is enhanced to make full utilization of the DNA databases.

CHAPTER THREE

STRATEGIC PLANNING

Within this chapter, a strategic plan will be outlined that will focus on a mid-sized law enforcement agency's ability to keep up with current crime scene investigation techniques and trends to fully utilize the expanding CODIS database. Through information revealed and discussed in the previous chapters, it is reasonable to conclude that DNA databases will continue to expand through the year 2008. The expansion will continue to include DNA samples recovered from crime scenes, DNA profiles taken from individuals convicted of specific crimes, and parents of missing children. DNA databases will expand and become even more beneficial, similar to the way fingerprint databases have become a tool for law enforcement to identify subjects and match forensic evidence found at crime scenes.

For mid-sized law enforcement agencies to use these databases to their fullest potential, many of the current methods of crime scene investigation and evidence collection will need to be reevaluated. As the back log of cold cases are entered and cleared through CODIS, a greater focus will need to be given to the collection of DNA forensic evidence at all crime scenes, not just sexual assaults and homicides.

Eventually, DNA-typing technology will enable law enforcement to conduct in-field identification of individuals by comparing their DNA against CODIS, or other international databases. Once that technology is available, it will also be possible to locate evidence at a crime scene, conduct an infield profile match, and then enter that match into the CODIS database. Based on the research and information revealed from

the Nominal Group Technique, this type of advancement will take place, but it is doubtful in the next five years.

Before developing the strategic plan, it is essential that the purpose and components of the plan be understood. A strategic plan is a management tool that looks at tomorrow's problems, rather than today's. It is a tool, similar to a road map, which attempts to resolve a situation or problem, rather than the symptoms of that issue. It serves to focus the resources and energy of an organization insuring the efforts are pointed in the direction of addressing the future.

Most mid-sized law enforcement agencies have their own crime scene investigation unit and crime lab. The extent of the capability of these crime labs varies, and many departments contract with larger agencies to perform crime scene investigation. They usually limit this extra cost to high profile serious offenses like homicide. Most large law enforcement agencies already have the lab capability to process DNA evidence, but the focus of this issue is addressed towards a mid-sized law enforcement agency.

The vision or purpose of the strategic plan is to prepare and equip a mid-size law enforcement agency's ability to maximize its ability to identify, collect, preserve, transport, and store DNA evidence to be compared to and entered into CODIS. To accomplish this goal, a mid-sized law enforcement agency will need to reevaluate and expand current operational budgets. The basic CSI officer will need to attend more training that addresses DNA issues. Property storage and evidence lockers will also need to expand and adjust current methods to adhere to changing case law and storage requirements.

Situational Analysis

The first step in developing a strategic plan is following the situational analysis method. This evaluates the potential environmental threats and opportunities and organizational strengths and weaknesses and their impacts on the proposed strategic plan.

Strengths: The current CODIS system is established and has been increasing in its profile database. It has become a foundation of DNA information that can easily link up to other international databases for a more robust comparison field. Federal funding continues to be committed to the growth and security of all databases.

Weakness: Very few forensic technicians from mid-size agencies have the training and expertise to examine DNA evidence and profile it for inclusion into the CODIS system. This training is highly sophisticated and the current personnel have had to prioritize the level of case examination and profile inclusion. If crime scene technicians are going to keep pace with this expanding technology, more specialized training will need to be offered.

Opportunities: The strategic plan, which calls for a task-force approach towards DNA collection at crime scenes, may become the industry norm in law enforcement's attempt to keep up with expanding technologies. The current lack of funding may force this task force concept to be the only way mid-sized law enforcement agencies can conduct effective crime scene investigations. Until sufficient personnel can be trained, law enforcement may have to pool their resources.

Threats: The potential for misuse or corruption of current and expanding DNA databases could damage evidentiary value of samples and public opinion that the government has possibly gone too far. If insurance companies gained access to potential customer's DNA, discrimination could occur.

Stakeholder Analysis

Stakeholder analysis is a technique used to identify and assess the importance of key individuals or institutions that may significantly influence the success of the strategic plan. The stakeholder analysis is used to anticipate the type of influence these individuals will have on the plan and will help to develop strategies to implement the program.

The stakeholder analysis matrix provides a visual aid to determine who is impacted by the proposed plan, as well as who could affect the plan. It is apparent that critical stakeholders need to be included. Groups or individuals who may have a negative influence are referred to as "snail darters." At all stages of the plan, snail darters have the potential to impact progress and effectiveness. Because of this, the stakeholders' list must be periodically reevaluated to include input and update them as current stakeholders.

Table 3.1 Stakeholder Analysis

Stakeholder	**Stakeholders Interest in the Project**	**Assessment of Impact**	**Potential Strategies for Obtaining Support or Reducing Obstacles**
Law Enforcement	Public Safety/Service Level/Efficiency	High	Increase Operational Budget/Re-allocate Resources
Forensic Laboratory	Public Safety/Efficiency	High	Provide Training/Increase Staffing Levels

County District Attorney	Public Safety/Impact on Case Prosecution	High	Increase Number of Convictions /Prior to Trial
Criminal Defense Attorney	Protection of Civil Rights/Due Process	Moderate	Efficient Collection and Processing DNA Evidence
Legislators	Political/Public Safety	Moderate/High	Pass Laws to Include All Felons/Expand CODIS

Objectives

It has taken years to enter all the DNA profiles into the CODIS system. As local, state, and federal laboratories catch up with the backlog of cold cases and DNA samples, the system will be able to handle future legislation that will include all felons. This couldn't have been done at the inception of the program and the amount of cold case examination will eventually decrease. The same example of starting out with a manageable goal applies to the objective of any strategy.

To achieve the full use and effectiveness of the CODIS system, law enforcement must take it one step at a time. The first step of awareness of DNA evidence has been achieved by the publication of the brochure, "What Every Law Enforcement Officer Should Know About DNA Evidence." Specialized training in DNA forensics is needed to move toward the goal of greater effectiveness. It has been difficult to standardize DNA training due to the different state mandates and the rapid changes experienced in technology. The knowledge level is minimal with respect to DNA evidence and collection procedures. In the past, the only time DNA was collected was during crime scene investigations, usually by forensic technicians and personnel involved in serious crime follow-up, like rape and homicide.

One of the objectives of the full use of CODIS is to create computer-based training specific to the various needs of all law enforcement and prosecution stakeholders involved. Small organizations get a fair amount of training as far as criminal

investigations are concerned but nothing specific most of the time with respect to DNA evidence collection. It is the objective of the strategy to ensure that officers know about DNA evidence and know how to maintain control of the crime scene and to collect it.

Strategies

It is apparent the CODIS system will continue to expand and the line-level officer will need training and expertise in DNA evidence identification and collection. A strategy is pooling resources and establishing a mutual aid task force that will respond to various crime scenes. In the past, crime scenes have been handled by field officers and less trained technicians. Mid-size agencies either need to make new experts to handle the increase in DNA evidence collection, or make better use of the current resources by sharing personnel. Either way, the increased use of the CODIS system will cause an increase in cost for all law enforcement agencies.

Another strategy to focus on DNA evidence collection should result in an increased efficiency in criminal investigation. Many mid-sized law enforcement agencies do not experience the amount of serious crimes to support a lab with trained and qualified personnel. As DNA evidence becomes the day-to-day standard for evidence collection at all crime scenes, mid-sized agencies will need to improve their current lab capabilities.

The vision explored in this chapter is one of a collaborative effort between local law enforcement, CODIS-based crime labs, and the local prosecutor. If any of these current stakeholders resists the expanded use of CODIS to process all crime scenes, the foundation that has taken years to establish will be ineffectual.

CHAPTER FOUR

TRANSITION MANAGEMENT

Implementation will generally be initiated by the new discoveries in DNA technology and their application to criminal investigations. The benefit will be apparent to all stakeholders involved that forensic DNA is an effective tool for solving crime and is here to stay. As the public grows more familiar and accepting of DNA evidence, law enforcement leaders, from mere public pressure, will need to keep up with technology. The citizen they serve will demand it. Political pressure will also result in the passing of broader legislation for wider inclusion of samples from convicted criminals into the CODIS system.

As of today, police agencies possess adequate resources and personnel to process crime scenes and recover forensic DNA evidence on serious offenses. Police managers should prepare for the discovery of new DNA technology that will expand their crime solving potential. Part of that preparation will be the need to budget sufficient resources to expand current crime labs, train and equip crime scene investigators, and purchase field equipment that once it is offered, will be very expensive.

The critical mass of individuals whose active commitment will be necessary to effect change, can be the forensic specialists. With the increase collection and processing of DNA forensic samples, their workload may increase and become difficult to handle.

Commitment will be needed from forensic specialists to ensure the effectiveness of change. DNA evidence takes time to process. As more DNA evidence is collected

from crime scenes, backlogs in case filings and database entry will increase. A commitment plan includes identifying forensic specialists and mid-sized agencies willing to participate in a taskforce. Not all forensic specialists will want to work in a taskforce setting. An intervention strategy may come from the leadership of various professional associations for forensic specialists or the chiefs of police.

The degree of commitment from forensic specialists can be measured by commitment charting. Not every member will make the changes happen. The strategy of establishing a taskforce may face resistance. It would be necessary to get the minimum commitment from all involved.

Chapter 5 will summarize findings brought to light during the course of this paper. A recommendation will be made to expand law enforcement's current ability to change DNA collection procedures. Mid-sized law enforcement agencies will be faced with unique challenges based upon current budget constraints and the frequency with which serious offenses occur.

Commitment Chart

Key Players	No Commitment	Let It Happen	Help It Happen	Make It Happen
Law Enforcement				X
Forensic Lab				X
District Attorney			X	
Defense Attorney	0	X		
Legislators				0X

X= Present degree of commitment. 0= Minimum commitment required.

CHAPTER FIVE

FINDINGS AND CONCLUSIONS

Summary

This research has addressed the potential impact that DNA databases will have on a mid-sized law enforcement agency's ability to conduct crime scene investigations. DNA databases will continue to expand and eventually link with other international databases. Sample profiles of DNA will include a broader base of convicted criminals, not just sex offenders and convicted murderers.

The CODIS system is the foundation for the future use of DNA evidence for law enforcement. Cold case DNA evidence and non-suspect forensic DNA from crime scene will continue to be entered into the CODIS system. The parents of missing children will also continue to be included into CODIS.

More resources will need to be devoted to training. As mid-sized agencies, as well as smaller agencies, become more aware of what DNA forensic evidence can and can't do, there will be a greater desire to use it for other various lower profile cases. All law enforcement agencies need more extensive training and education. The current brochure, "What Every Law Enforcement Officer Should Know About DNA," is already available and is raising awareness in the ranks of field personnel.

The frequency of property crime is much greater than violent crime. Mid-sized agencies will see a tremendous advantage in using DNA technology for the investigation of the largest percentage of crime, that is: burglary, theft, and auto theft. As this happens, crime labs will be overwhelmed with DNA evidence to be processed and entered into

CODIS. As training improves, so also will the quantity of DNA forensic evidence. This will put a burden on local crime labs that are already burdened with a backlog of DNA evidence to be processed.

Major funding will need to be directed for expansion of the capabilities of local labs to access CODIS and process forensic DNA evidence. Mid-sized agencies should generate enough crime scene evidence to justify an in-house forensic lab capable of conducting these types of examinations. Regional and state labs are already overwhelmed and will not be able to take on the added number of DNA samples as technology expands and training and awareness increases.

Mid-sized agencies may have to look at pooling resources and possibly creating a DNA crime scene investigation task force to respond to all cases involving DNA forensic evidence. The task force approach may be a tool for local agencies to become more efficient and effective at crime scene investigation. The task force would include personnel from all agencies, and they would respond, as needed, to locate, collect, transport, examine, and store DNA forensic evidence.

Recommendations

It is recommended that all law enforcement agencies, not just mid-sized, redistribute the current published brochure from the National Commission on the Future of DNA Evidence. Agencies need to require their crime scene investigators, whether sworn or civilian, to attend specialized training specific to forensic DNA evidence.

Mid-sized agencies that have their own crime lab will need to train the forensic specialist to profile DNA samples and, ultimately, to access the CODIS system for entry

and comparison. This will be possible as DNA technology increases the capabilities and speed with which a DNA profile can be identified from forensic evidence.

The overall cost factor is of major concern. During these hard economic times, mid-sized agencies will need to prioritize their budgets to allocate sufficient funds to pay for the needed improvements in personnel, training, and equipment acquisition. Current property and evidence rooms will need to expand to meet the increasing demand for storage of DNA evidence.

In the next five years, the cost of forensic infrastructure will be great. State and federal political leaders will need to be encouraged to make grants and other funding sources available. Local government will not be able to afford the start up costs to complete a DNA forensic lab. Mid-sized agencies may need to pool their resources while the anticipated growth occurs.

Conclusions

DNA databases continue to grow and expand. One day, they may even be used for field identification of individuals and immediate identification of forensic evidence. The advances in DNA profiling will ultimately result in a process that will enable trained and qualified technicians to analyze forensic evidence while at the crime scene. Once evidence that contains DNA is examined and a DNA profile is identified, that profile can then be sent to the CODIS system using wireless communication technology from the scene. If a preliminary match is made comparing DNA with current database profiles, identification can be made, and either a mug photo or DMV photo could be accessed and given to investigators immediately.

Using this scenario, the speed in which dangerous suspects could be taken into custody would be greatly enhanced. Wrongly accused suspects could be immediately eliminated in the field, avoiding long trials and unnecessary costs.

The CODIS system has proven to be a successful tool in bringing criminals to justice, protecting the rights of falsely accused individuals, and the identification of missing children. The overall effectiveness of this tool can only be measured by its maximum potential use. The CODIS system will never be used to its potential without current first responders, follow-up CSI investigators, and forensic specialists being better trained and equipped.

DNA databases will impact mid-sized law enforcement agencies over the next five years. Increased costs for training and hiring personnel will need to be factored into the budget process. Collection and storage costs of DNA evidence will also increase. If the taskforce strategy is used, a legal agreement will be needed to set procedures for use. Each agency involved will need to share resources in proportion to their use. Training outlines will need to be written and collection equipment purchased.

As law enforcement improves its ability to use DNA to identify and convict suspects, recover and identify missing persons, match serial offenders to various crime scenes, and ultimately conduct in-field identification, the CODIS system will grow in its effectiveness.

Until the priority is shifted and the full use of DNA technology is employed, mid-sized law enforcement agencies will be less effective in crime prevention, criminal apprehension, and investigative follow-up. The public will eventually demand law enforcement use this technology for their protection.

APPENDIX A

NGT Panel Members

Camile Hill	Sr. District Attorney Orange County District Attorney's Office
Russell Baldwin	Forensic Sciences Service Orange County Sheriff's Crime Lab
Steven Booze	Police Homicide Detective Orange Police Department
Aurora De Los Reyes	Paralegal-DNA Orange County District Attorney's Office
Trish Sharkey	Forensic Specialist Orange Police Department
Patrick Thayer	Detective Sergeant Orange Police Department
Virna Manuel	Law Student
David Schweitzer	Crime Scene Investigator Orange Police Department
Andrew Key	Police Captain South Gate Police Department
Michelle Molko	Undergraduate College Student

APPENDIX B
NGT TRENDS

1. Voluntary usage of ID implants
2. Department lab access to databases
3. Storage and maintenance of forensic evidence
4. Growth of databases and their integration
5. Evidence collection at crime scenes focusing on DNA and handling and increase in evidence
6. Technological advances to improve testing
7. Increase in types of crimes that can collect DNA from (arrestees/convicted criminals)
8. Different types of DNA databases may emerge (now: 13 markers→later: mitochondrial)
9. Collect DNA from people other than criminals
10. Acceptance of DNA by general public and juries
11. Federal or international sharing of databases
12. Training in law enforcement and judicial system
13. Negative impact if not prepared/trained
14. Resistance from public—privacy issues
15. Concern about people being "human tags"
16. Prisoner resistance
17. Increased planting of evidence
18. Increase in cost to increase, store, and process samples
19. Statute of limitations are reexamined

20. More access/demand by defense for retesting of forensic evidence
21. Entrapment issues
22. Cloning issues
23. Legal challenges (more effective DNA→more challenges from scientific community)
24. Quality control (contamination) and database access
25. Chain of evidence issues
26. Security of databases of DNA
27. Analysts being overwhelmed leading to contamination
28. Collection processes will change
29. All agencies will have crime labs
30. Civilianization
31. Specialization of CSI
32. Multi-disciplinary approach
33. Forget basics/standards
34. Direct linking of DNA to diseases (privacy issues, insurance, employer discrimination)
35. Penalties for DNA-related crimes
36. Simplified sampling procedures
37. John Doe warrants
38. Different types of DNA evidence (animals, plants)
39. Funding from victims
40. Databases used to get consensus

APPENDIX C
NGT EVENTS

1. Case—wrong ID
2. New law—DNA at birth
3. Altering of DNA
4. New law prohibiting DNA
5. Mishandling case in press
6. Handheld DNA device created
7. Hacking event with DNA
8. Creation of DNA identification system
9. Federal mandate—uniformed database worldwide
10. Case law related to death penalty and DNA
11. Scientific advancement to call 100% certain identity
12. Mid-size agencies work together (networking, creating a multi-agency task force)
13. Access to system for input of DNA samples
14. Legislation enacted to include all arrestee samples in databases

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