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The Application of DNA Technology in England and Wales

By
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Executive Summary

England is widely recognized as having the most effective and efficient approach to the use forensic DNA technology in the world. With a forensic database that currently contains the DNA profiles of over two million individuals, the National DNA Database of England and Walesⁱ:

- **Delivers over 1,700 crime scene to crime scene or suspect to crime scene hits per weekⁱⁱ**
- **Maintains a 40 percent chance of obtaining a match between a crime scene profile and a “criminal justice” (arrestee or suspect) profile loaded into the database**
- **Adds between 8,000–10,000 arrestee or suspect profiles to the database per week**
- **Adds between 1,000 to 1,500 crime scene profiles to the database per week**
- **Increases the suspect identification rate for domestic burglary from 14 to 44 percent when DNA is available at the crime scene**
- **Solves 0.8 other crimes for each crime solved with DNA**
- **Prevents 7.8 other crimes for each custodial sentence resulting from a DNA based conviction**
- **Will contain profiles of the entire “criminally active population” by March 2004ⁱⁱⁱ**

This paper identifies those factors which contribute to the successful application of DNA technology and DNA databasing as an investigative tool, fully integrated into the criminal justice system.

LEGISLATIVE FOUNDATION

- 1. The foundation of the Database system's success is the series of Parliamentary Acts establishing the right of law enforcement to collect and profile individuals arrested for or suspected of committing a crime. Empowering police to obtain DNA from arrestees and to use the database during the investigative process, rather than subsequent to any possible conviction, provides numerous advantages. It allows them to:**
 - solve cases faster,**
 - consolidate cases (and thus valuable resources) before trial,**
 - detain dangerous individuals arrested on a minor charge but identified as having committed a much more serious offense,**
 - exonerate innocent suspects more quickly.**

- 2. Legislation also establishes the ability of law enforcement to obtain DNA profiles for individuals arrested for or suspected of "any recordable offense." With this legal authority, the Home Office has established the goal of DNA databasing the "entire active criminal population."^{iv} Currently, the database population stands at approximately two million individual profiles. By nature of its size, the database matching potential increases. However, it is the ability to profile individuals arrested for relatively minor offenses which provides police the ability to solve more serious crimes.**

FUNDING

- 3. The National DNA Database (NDNAD) is well funded. In April 2000 the Home Office instituted the DNA Expansion Program calling for an investment of £182 million (\$270 million). With a population of approximately 52 million (England & Wales), that equals approximately \$5 per citizen invested in DNA databasing. With a population of approximately 291,000,000 the US would have to invest over one billion dollars to achieve a similar ratio.**

- 4. In England and Wales, the DNA expansion funds are provided directly to police departments. While allowing investigating agencies the flexibility to apply grant monies for DNA testing as they see appropriate, direct funding also forces departments to make better decisions about which samples are forwarded to the laboratories for analysis. Smarter submission decisions result in better resource management.**

VOLUME CRIME APPLICATION

- 5. The NDNAD is not limited to use in homicide, sexual offenses and other violent crime. Police agencies actively and routinely use DNA and the National DNA Database to solve “volume crime.” Volume crime consists of burglary, car theft, criminal damage and other less violent offenses. In 2001–02, half of all cases submitted by police to the Forensic Science Service were for volume crime offenses.**

TURN AROUND TIME

- 6. Turn around time is a high priority. Aggressive targets for quick sample processing turn around time are set and strictly monitored by the Home Office. The nationally established target for crime scene sample analysis is 24 days. Arrestee and suspect samples are usually analyzed within five days, with a demand of 30,000 per month.**

Introduction

England is widely recognized as having the most effective and efficient approach to the use forensic DNA technology in the world. Since the establishment of the National DNA Database (NDNAD) on April 10, 1995, England has become a world leader in discovering innovative ways to use DNA to identify suspects, protect the innocent, and to convict the guilty. DNA technology and DNA databasing has become central to the process of criminal investigation. The decision to integrate DNA technology so thoroughly and the subsequent success of the National DNA Database can be attributed to three major factors: the political will of the Home Office, the technical capability of the Forensic Science Service and the operational desire of the Police.^v

The foundation of DNA driven investigations in England and Wales is its expansive DNA database. Many factors however, contribute to the success of the UK’s approach to forensic DNA applications. This report will consider those factors.

England has a population of approximately 52 million.^{vi} It has 43 municipal police forces with total police personnel of over 123,000.^{vii} Also, 90 percent of the forensic DNA

analysis performed in the England is performed by one, quasi-governmental agency, the Forensic Science Service (FSS). Further, not only does the Forensic Science Service retain the vast majority of the country’s forensic DNA analysis, it is also the official custodian of the DNA database, an authority granted by the Association of Chief Police Officers (ACPO).

The United Kingdom averages two million arrests per year. However, statistics show that less than one quarter of these arrests are of first time offenders.^{viii} Further, it has been shown that 85 percent of offenders receive their first conviction between the ages of 14 and 19 with the likelihood of a 14 year-old re-offending at 77 percent.^{ix} Government statistics also show that 20 percent of the criminals commit 80 percent of crime and 60 percent of court appearances deal with only 21 percent of offenders.^x

The Progression of Database Laws in England and Wales

Since its establishment in 1995, the National DNA Database has received consistent legislative expansion and financial support from the UK Government. Through a series of Parliamentary Acts from 1993 through 2003, police have seen their ability to reap the benefits of DNA technology steadily enhanced.

In 1991, the Royal Commission on Criminal Justice was established as a result of concern about public confidence in the criminal justice system. One example of that concern was the quashed conviction of the “Birmingham Six,”^{xi} the exonerations of whom were handed down the same day that the Commission was announced. When the Commission published its recommendations in 1993, it stated that “there should be clear legislative provision for the more extensive storage of DNA samples or data both for the purpose of identifying offenders...”^{xii} Given the Commission’s genesis, the Government endorsed

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Also in 1993, the House of Lords' Select Committee on Science and Technology recommended that, given a lack of legislative authority for the collection, retention and use of biological samples, the government clarify the laws empowering police to use such evidence. In 1994, the Home Office commissioned the Metropolitan Police Forensic Science Laboratory to perform a pilot study to examine the use of DNA in the context a forensic database. As a result of the Met study, the Home Office decided to pursue the creation of a forensic DNA database.

Thus, from its inception, the NDNAD was a database driven, not by the use of convicted offender profiles, but rather by the use of profiles developed from individuals merely suspected of crimes.

The first Parliamentary Act establishing the authority to create a criminal DNA database is the 1994 Criminal Justice and Public Order Act (CJPOA).^{xiii} “The central and most far reaching, aspect of the CJPOA was the framework it created for the police administration of DNA sample collection necessary for profiling.^{xiv} The

CJPOA broadened the scope of suspects from who samples could be taken to those charged with any “recordable offense.” This represented significant expansion beyond the “serious arrestable offence” scope of offenders that was established by the 1984 Police and Criminal Evidence Act (PACE).^{xv} Thus, from its inception, the NDNAD was a database driven, not by the use of convicted offender profiles, but rather by the use of profiles developed from individuals merely arrested for or suspected of crimes. However, according to the CJPOA, only those cases in which the suspect was convicted would the individual’s profile be maintained on the database.

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Importantly though, the CJPOA also amended the types of biological samples that could be collected from suspects. “Through a reclassification of the sample types defined as

‘intimate’ and ‘non-intimate,’ the CJPOA redefined PACE to incorporate saliva and mouth samples in that category of non-intimate body samples which can be taken without consent and, crucially, by the police themselves.”^{xvi} In other words, while the 1984 PACE Act allowed for the collection of evidence from suspects, that evidence was limited to non-intimate samples, i.e.: fingerprints. DNA sample collection, absent the change of language to include saliva and mouth samples as “non-intimate” would have left DNA, for all practical purposes, un-collectable. Further, by facilitating the use of buccal swabs for sample collection, the CJPOA simplified sample collection and reduced cost significantly.

While the CJPOA called for the expungement of profiles if individuals who were not ultimately convicted, periodic problems with database administration ultimately led to a number of cases in which suspects were identified by samples which were retained in the system but should have been removed. This led to a number of court cases and a decision from the House of Lords addressing the legality of such identifications. Ultimately, the issue became one of discretion for the court.^{xvii}

Thus, the 2001 CJPA allows for the collection and retention of DNA samples and profiles for anyone who becomes a suspect during the course of an investigation.

To address these public policy and legal issues, the House of Lords passed the 2001 Criminal Justice and Police Act (CJPA) which “...can be seen as a direct outcome of the problems of admissibility and retention.”^{xviii} The Act provides for the indefinite retention of DNA profiles on the NDNAD even if suspects are not convicted or “cautioned” for a crime.^{xix} It also allows for the indefinite retention of profiles and biological samples given voluntarily with written consent, such as through mass screenings. Thus, the 2001 CJPA allows for the collection and retention of biological samples and DNA profiles for anyone who becomes a suspect during the course of a police investigation.^{xx}

As for the impact of the legislation on the success of the NDNAD, the Chief Executive Officer of the Forensic Science Service says, “It simply could not have been as successful without the ability to profile suspects and to do so for all recordable offenses.”^{xxi}

Pending legislation, expected to pass Parliament, would allow the routine sampling of all arrestees. This will have the effect of eliminating the requirement of police supervisory approval to take a DNA sample. DNA sampling will essentially become an administrative function.

The Forensic Science Service

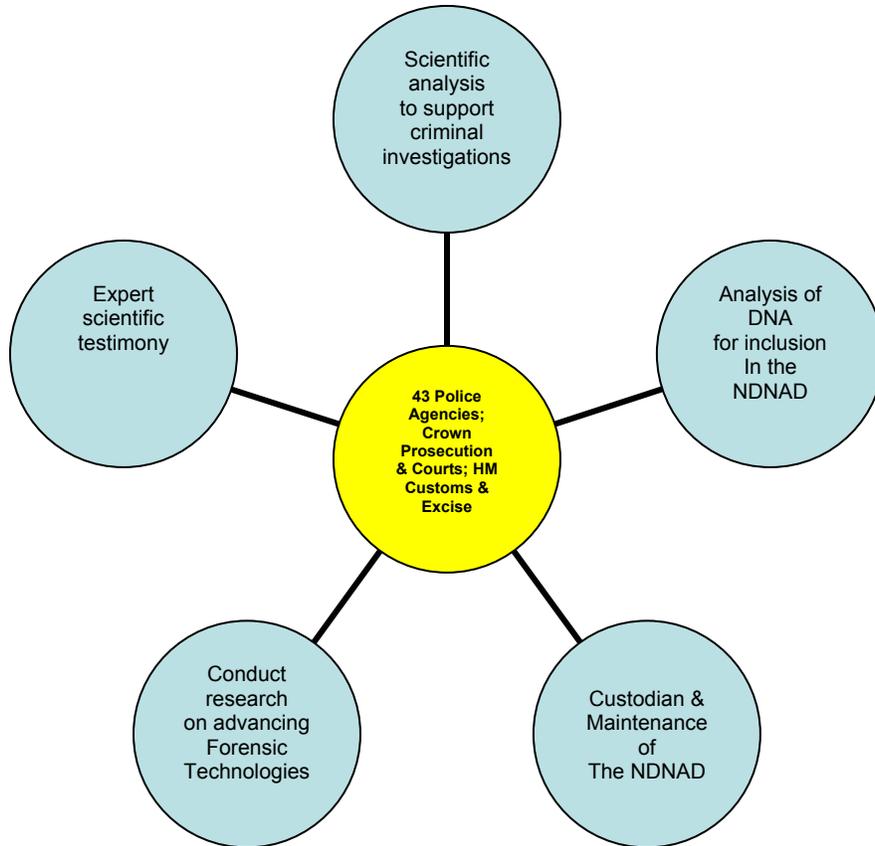
Given the 90 percent share of DNA analysis performed by the Forensic Science Service, the fact that it is the one DNA laboratory officially associated with the government and the fact that the FSS is the DNA Database custodian, it is important to understand the structure of the FSS to understand how DNA technology is used so effectively.

The Forensic Science Service was established as an Executive Agency, part of the Home Office, in April 1991. In April 1996, the FSS merged with the Metropolitan Police Forensic Science Laboratory, London’s Police Laboratory, and as a result, the FSS is now the largest supplier of forensic science services in the UK. Similar to the Federal Bureau of Investigation’s Laboratory, the FSS is responsible for various kinds of forensic testing, not just DNA. Its specialists respond to crime scenes both for the identification, preservation and collection of evidence as well as for the advice and support of police investigators. FSS experts provide testimony in criminal trials and significantly, it is the custodian of the National DNA Database. The FSS also maintains a research facility which is responsible for developing forensic science breakthroughs and innovations - particularly in the application of DNA technology.

While the FSS currently operates as a non-profit organization, it is a fee-for-service agency. On April 1, 1999, the FSS was given “Trading Fund” status which allows it to

Exhibit 1

Services Provided by the Forensic Science Service



retain surplus cash at the end of each financial year and carry it over to the next. This allows for surplus finances to be spent on research and improving customer service.^{xxii}

Today, the FSS maintains seven working laboratories with 2,700 staff and provides forensic analysis services to private, public and overseas customers as well as the 43 police forces in England and Wales and other police forces such as the Ministry of Defence Police, British Transport Police, the Crown Prosecution Service and Her Majesty's Customs and Excise Service (Exhibit 1). Between 2001-02,^{xxiii} the FSS analyzed forensic evidence in approximately 130,000 cases as well as 555,000 samples of DNA, of which 480,000 were added as profiles to the National DNA Database. That

means that approximately one half of all cases were submitted for DNA testing, compared to one quarter in 1997-98. Since 1996-97, the total number of cases received from law enforcement has increased 52 percent.^{xxiv}

The FSS operates in a commercial market valued at £160 million. And while the agency maintains over 90 percent of the overall forensic market in the UK, it competes with other forensic service providers which hold the remainder of the market. Given the market share maintained by the FSS and its role as database custodian, this report focuses largely on the role of the Forensic Science Service.

With annual operating costs of £122 million the FSS is required to cover its costs through its fee-for-service structure. In 2001-02, the FSS had an operating income of £128 million, over 90 percent of which came from the 43 police forces of England and Wales. Charges for forensic analysis are based either on an hourly (for example, £110 per hour for crime scene attendance) or per item basis (for example, £195 to search an item for body fluids).^{xxv}

Direct Funding to Police Agencies

As mentioned previously, the FSS is a “fee-for-service” agency. Therefore, funding programs such as the DNA Expansion project (discussed in greater detail later) allocate their funding directly to the law enforcement agencies rather than to the forensic

laboratories conducting the analysis. This direct funding encourages individual police departments to request DNA testing in a more thoughtful and judicious way. Rather than simply sending every conceivable biological sample to the laboratory for testing, national DNA funding made directly to the police requires that their submissions are well considered. Since the number and quality of samples sent to the laboratory affects the police department’s budget, (rather than the laboratory’s) departments benefit from better

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training and better evidence submission policies. The better trained their own scientific support personnel are at identifying evidence which might provide a relevant DNA profile, the less departmental funding gets wasted on unsuccessful DNA tests.

A consistent problem in those United States forensic systems is the tendency for law enforcement (or prosecutors) to simply send “everything” to the laboratory for testing. Often this is possible from the police perspective because the cost of the analysis doesn’t come out of their budget rather; it is expensed through the laboratory system. The system in England and Wales however, provides incentives for the police to be better trained at identifying quality evidence.

The National DNA Database

The FSS pioneered the use of DNA profiling in forensic science and set up the world's first national criminal intelligence DNA Database - launched in April 1995. The structure and use of the National DNA Database however differs significantly from the structure and use of the local, state and National DNA databases of the United States. While in the United States, the National DNA Indexing System (NDIS) is based on a system in which only convicted offender profiles can be entered and searched against crime scene profiles, the UK National DNA Database is driven by the use of suspect profiles. In England and Wales, police have powers to take and retain biological samples from those:

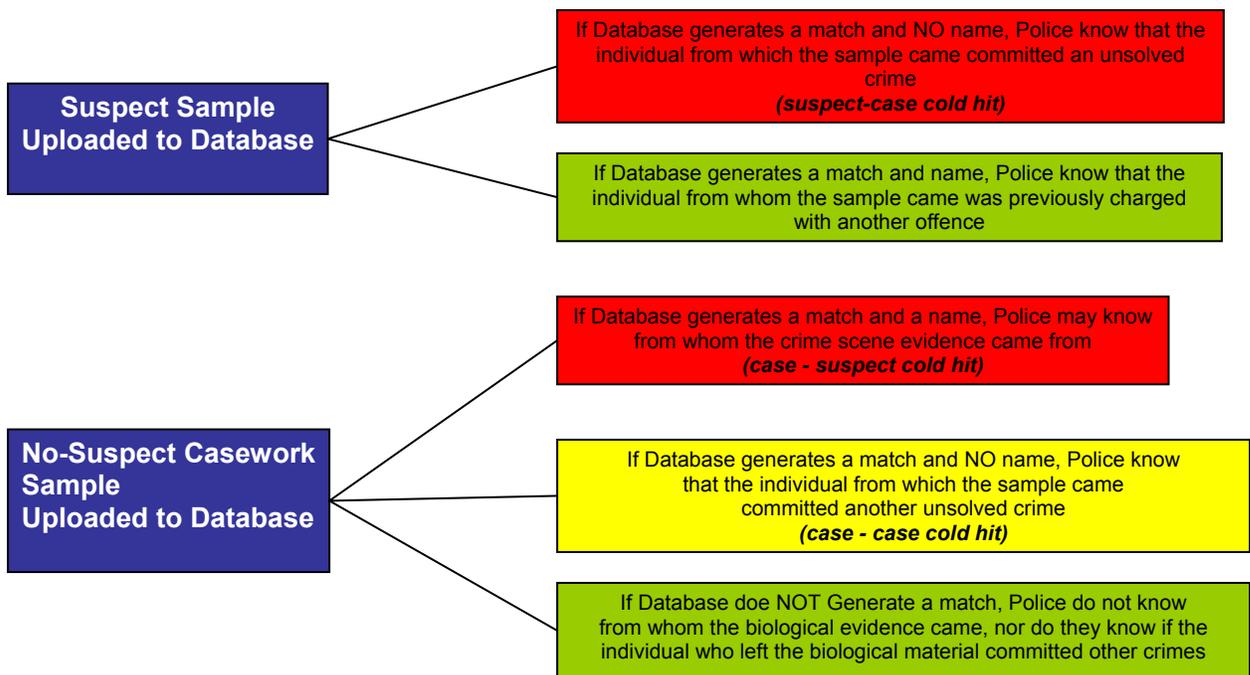
- charged with or informed they will be reported for any recordable offence,^{xxvi}
- where an Inspector has reasonable grounds to suspect the involvement of the individual in a recordable offence and,
- the DNA sample will tend to confirm or disprove his involvement in the offence.^{xxvii}

Further, legislation is currently pending which would allow police automatically to take a biological sample from anyone arrested for a recordable offense. This would, in arrest cases, eliminate the requirement of an Inspector’s assessment and approval. Such approval would then be necessary only in cases in which the suspect was not yet arrested.

The National DNA Database currently contains 2,017,020 profiles from individuals suspected of, and/or arrested for “any recordable offense.”^{xxviii} These DNA profiles are referred to as Criminal Justice or “CJ” profiles. By contrast, the NDNAD contains 200,614 unsolved crime scene profiles. And while 268,278 suspect profiles and 43,214 crime scene profiles have been removed pursuant to previous PACE requirements, those removal requirements no longer exist.

Exhibit 2

How the National DNA Database can be used to aid criminal investigations



On a weekly basis, between 8,000 to 10,000 new CJ profiles and 1,000 to 1,500 new crime scene samples are added to the National DNA database system.^{xxix} Partial profiles

can be entered into the database and currently make up 11 percent (22,849) of the unsolved crime scene profiles.

The success of the NDNAD can be seen not only in the number of matches made but also in the varied nature of the crimes matched. From April 1995 to the end of January 2002, the majority of matches were not made in rape, other sexual offenses or murder. Instead, the largest numbers of matched crimes were commercial and residential burglaries.

Exhibit 3

Number of crime scenes matching one or more individual(s) by offense & year

Offence code					
	2000-01	2001-02	2002-03	2003-04	Total
Abduction And Kidnapping	8	42	43	24	117
Aggravated Burglary	0	6	7	6	19
Aggravated Burglary	16	183	251	93	543
Alc Tech Defence	0	1	1	1	3
Alcohol Technical Defences	0	2	1	1	4
Arson/Fire	1	3	13	3	20
Arson/Fire Investigations	13	84	134	54	285
Attempted Murder	8	68	107	40	223
Auto-Crime	382	1315	724	165	2586
Blackmail	1	5	9	3	18
Break In Offences	6	56	38	6	106
Burglary In A Dwelling	1033	7585	9567	2463	20648
C&E Export	1	1	0	0	2
C&E Fraud	0	0	0	1	1
C&E Import Drugs	0	2	1	0	3
C&E Import Other	1	0	0	0	1
C&E Projects	1	0	1	0	2
Corporate General Services	2	15	2	1	20
Criminal Damage	0	3	1	0	4
Driving After Consuming Drugs	1	3	4	2	10
Drugs Services – Other	0	2	13	6	21
Explosives	5	13	29	4	51
Gbh Assault	0	1	1	0	2
High Value Fraud	1	4	6	1	12
Import/Export Controlled Drugs	0	3	11	4	18
Less Serious Assault	29	242	495	111	877
Low Value Fraud And Forgery	5	60	77	31	173
Murder/Manslaughter	22	120	157	48	347
Other Serious	20	116	166	69	371

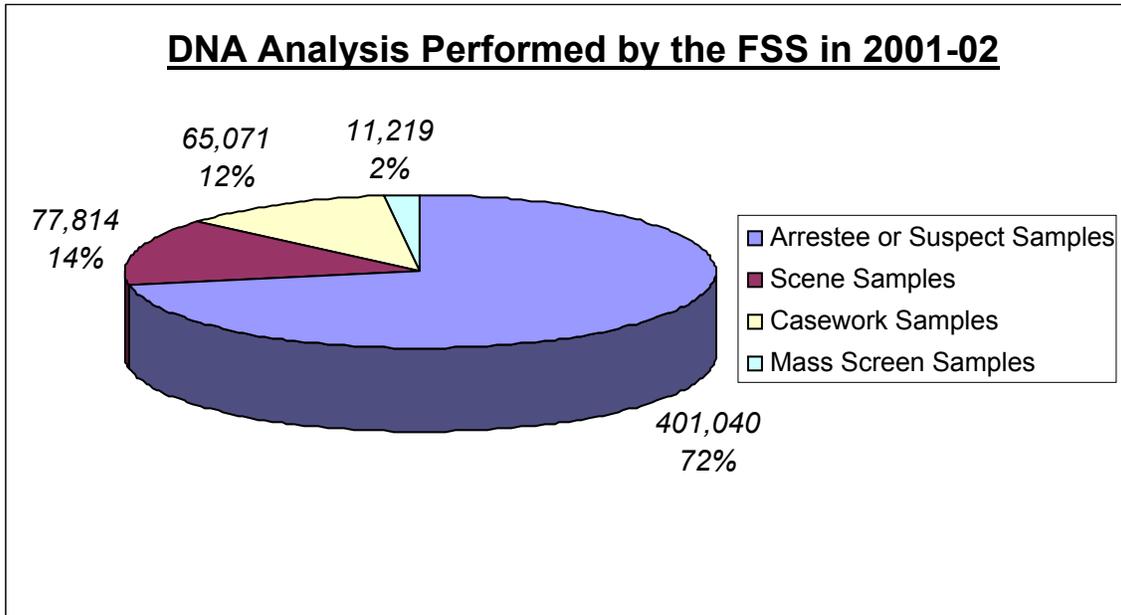
Offence code	2000-01	2001-02	2002-03	2003-04	Total
Other Sexual Offences	3	91	129	42	265
Other Specialist Services	0	4	1	0	5
Other Suspicious Death	1	11	20	7	39
Other Volume	22	460	789	214	1485
Possession Of Controlled Drugs	7	44	61	16	128
Possession Of Firearms	11	24	39	11	85
Production Of Controlled Drugs	3	22	29	9	63
Public Order	2	16	18	7	43
Rape	23	264	424	126	837
Robbery Serious	40	302	397	126	865
Robbery Volume	70	435	777	213	1495
Rta Alcohol	0	4	7	0	11
Supply Of Controlled Drugs	25	196	319	102	642
Supply Of Controlled Drugs (Std)	8	81	104	18	211
Terrorism	0	2	3	0	5
Theft	2	4	2	0	8
Theft From A Vehicle	434	3343	5032	1411	10220
Theft Inc Handling Stolen Goods	85	608	1137	414	2244
Theft Of A Vehicle	573	6215	10007	2592	19387
Traffic Offences Fatal	2	13	22	3	40
Traffic Offences Non-Fatal	18	225	572	203	1018
Unknown	284	711	254	203	1452
Use/Trade/Short/Convert Firearm	0	34	90	39	163
Wounding/Gbh	26	164	243	74	507
	5316	26267	35919	11397	78899

xxx

Database Success is Driven by Suspect Profiling

In fiscal year 2001-02, 72 percent of samples analyzed and entered into the database were from individuals, suspected of, charged with or about to be reported for, a recordable offense (Exhibit 4). While since 1997, samples can be taken from individuals convicted of certain categories of violent and other offenses; there technically is no “convicted offender” DNA database. As a practical matter, the extensive use of suspects profiling negates the necessity of a convicted offender database.

Exhibit 4



*Arrestee or Suspect Samples include non-intimate biological material collected from individuals suspected of, charged for, or about to be reported for any recordable offense

**Scene samples include biological material collected from unsolved crime scenes

***Casework samples are those which are submitted for analysis as part of a criminal investigation to establish a link to a known suspect in a crime

****Mass screen samples are those collected from volunteers in order to be compared with samples left at the crime scene under investigation.^{xxxi}

Over the next five years, crime scene to crime scene hits went as high as 3,357, but stayed in that range and numbered only 2,508 in 2001-2002. Suspect to crime scene hits however, increased every year to 58,176 in 2001-2002.

The effectiveness of suspect databasing can be demonstrated by comparing the number of crime scene to crime scene hits with the number of suspect to crime scene hits which have been made since 1996. In 1996, the National Database made 976 crime scene to crime scene hits. That same year, the database made 2,531 suspect to crime scene hits. Over the next five years, crime scene to crime scene hits went as high as 3,357 per year, but stayed in that range and numbered only 2,508 in 2001-02. Suspect to crime scene, or 'cold hits' however, increased every year to 58,176 in 2001-02.

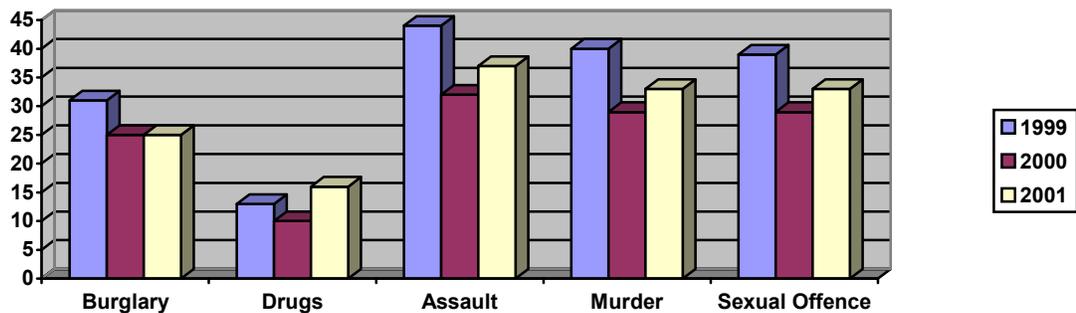
By searching suspect profiles against the database, links to other crimes can be established. Depending on the case, evidence from other cases can be aggregated to possibly strengthen the original arrest. Also, cases themselves can be consolidated to promote a more expeditious resolution to all crimes in which the defendant is implicated through the database. This conservation of resources can be accomplished either through the consolidation of trials or through negotiated pleas bargains. Thus the savings generated by solving crimes through the database extends beyond the benefits to the investigative process to the prosecutorial process.

The Critical Importance of Turn Around Time

Today, the average time for analyzing suspect DNA for inclusion in the database is five days, with a demand of around 30,000 samples per month.

A fundamental and overriding concern of the FSS and of the Home Office is the turnaround time of analysis of both casework and suspect samples. The Home office sets targets and strictly monitors the extent to which the FSS adheres to those targets. In fiscal year 1991-92 an average turnaround time of 45 days was found not only to be an unacceptable level of service, but more importantly, a danger to the criminal investigation procedure. By 1999-00, the FSS had reduced the average turnaround time to 26 days for casework, only two days above the nationally established target of 24 days.^{xxxii} Today, the average time for analyzing suspect DNA for inclusion in the database is 5 days, with a demand of around 30,000 samples per month.

Exhibit 5, Average Turn Around Time (in Days) by Type of Case



xxxiii

However, the rise of average case work turnaround time to 35 days in 2001-02 was again deemed unacceptable by a 2003 report of the Comptroller and Auditor General even though the FSS realized a 14 percent increase in case work volume. The report cited the reduction of time as the first of five major recommendations. To reduce turn around time, the report stressed: 1) the need to ensure adequate staff with the appropriate skill level; 2) the need to ensure police understand how forensic evidence should be submitted to ensure quality; 3) ensure equal distribution of cases between its seven labs; and 4) ensure evidence is sent to the most appropriate laboratory.

The Role of Law Enforcement Leadership

The Association of Chief Police Officers is the primary law enforcement leadership organization in England, Wales and Northern Ireland. It is not a staff association. Rather, its work is on behalf of the police Service instead of individual members.^{xxxiv} Its role is to set and maintain policy standards, ensure training for and compliance with those standards and to identify and promote good police practices. Representing only 44 forces, it has a greater ability and likelihood to speak with one voice than law enforcement in the United States. In many respects, its ability to act as a single, powerful force has helped to establish the NDNAD. However, even as effective as the use of DNA technology is in England and Wales, the government sees that police executives need to do more to ensure the full and proper application of the technology as a routine crime fighting tool.

In his June 2002 report and evaluation of the investigative use of DNA and fingerprints in the UK, Her Majesty's Inspector, David Blakey CBE, QPM, DL, MBA, identified Police leadership to be critical to the successful use of DNA to solve volume crime. Citing a previous 2000 Government evaluation, "Under the Microscope," which identified Police leadership to be a weak link in the chain of the technology's successful implementation, Blakey's subsequent report indicated that, in spite of some improvements, the UK police leadership has to take an even stronger role. The Inspector's first recommendation of the 2002 report was:

The ACPO and Chief Officers ensure that their strategy and supporting policies on the use of Forensic science to tackle volume crime are up to date, known and understood by operational officers.^{xxxv}

The recommendation is particularly illustrative in the context of efforts in the United States to integrate DNA more effectively into the criminal justice system. First, while the UK is the most effective country at implementing DNA technology to solve crimes, there is still much to be done to maximize its potential. In fact, according to the report's research, only 30 percent of the forces examined had a ranking officer championing the scientific support function and thus the routine use of DNA analysis. Further, the report was clear that the responsibility to maximize that potential falls squarely on the shoulders of law enforcement's leadership.

The second point of the recommendation that is relevant to US efforts is its specific reference to "volume crime." This emphasis can also be found in the report's recommendation on managing DNA evidence. It states:

That Chief Officers urgently review their SOCO (Scenes of Crime Officers) attendance policy for volume crime and their DNA submission criteria.^{xxxvi}

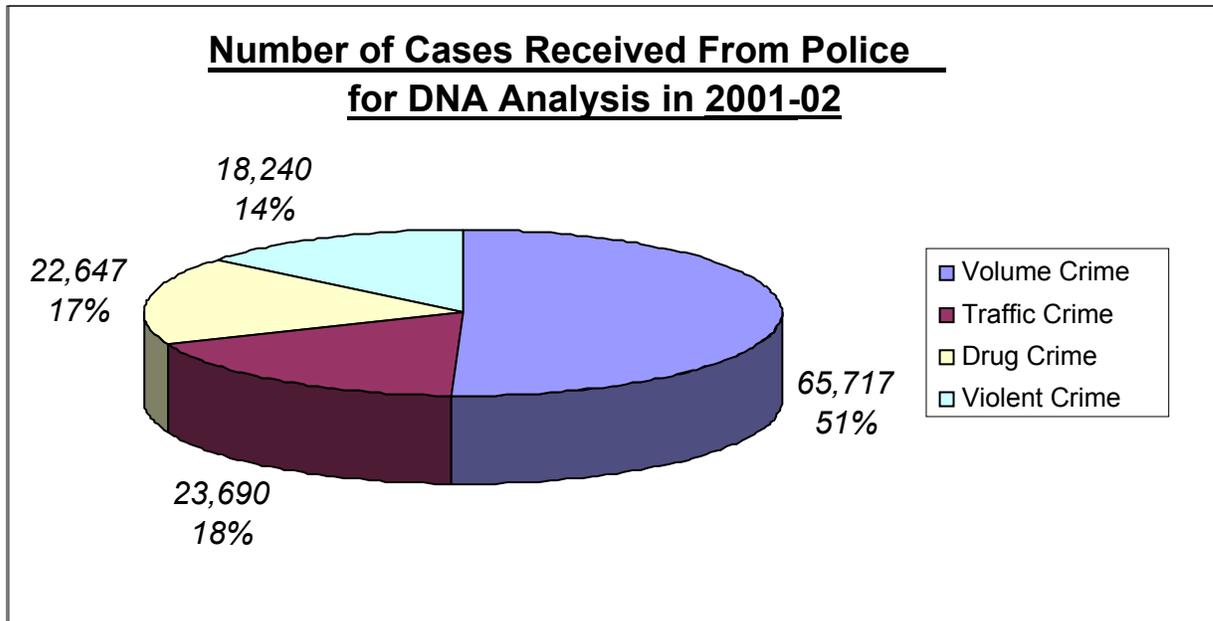
What is absolutely clear about the UK government's investment of money into DNA technology is that it expects the technology to be applied to more than just serious felonies.

Significantly, the report assumes the full implementation of DNA investigatory resources for serious crimes such as homicide, sexual offenses and other violent crime. Those crimes need not even be mentioned because DNA is already used systematically in those cases. Rather, the UK police forces need to move to the standardization of DNA's application to burglary, criminal damage, car theft, etc. What is absolutely clear about that the UK government's investment of money into DNA technology is that it expects the technology to be applied to more than just serious felonies. The expectation is that DNA and the DNA database will be used to solve every crime in which the discovery and analysis of a biological sample could lead to the identification of a suspect.

The DNA Database Application to “Volume Crime”

In the United Kingdom, the term “volume crime” refers to crimes such as burglary, car theft and criminal damage. Generally, violent crimes such as homicide, sexual offenses and other assault offenses are not considered volume crime. However, while DNA has traditionally been a tool applied to the investigation of assault-based or violent crimes, the NDNAD has been successfully applied not only to these, but also to less violent volume crimes. In 2001-02, over one half of the 130,000 cases submitted by police were related to volume crime. Only 14 percent related to violent crime, 17 percent for drug crimes (including possession) and 18 percent for traffic crime (Exhibit 6).

Exhibit 6



Counting Matches

The FSS uses two different methods of counting matches (hits) on the NDNAD, “pairwise matches” and “scene focused subject matches.” Pairwise match counting has been employed since 1995 and tracks all newly linked profiles. However, this approach fails to identify the actual number of cases in which a suspect was identified through the database. That often led to criticism that the success rate of the NDNAD was overstated.

Scene focused matching has been employed since May, 2001. This method counts new matches and additional matches to unsolved crime scenes separately, which more accurately reflects the number of suspects identified and is more valuable for police forces determining the success of the NDNAD.

DNA Expansion Program

In April of 2000, the Home Office instituted the DNA Expansion Program. This program called for the investment of £182 million (\$289.8 million) through March, 2004. The primary goal of the program is to have all DNA profiles from the entire “criminally active” population on the database by March 31, 2004. It is estimated that the “criminally active” population in the UK is approximately 2.4 million individuals. As of July 21, 2003, the database passed the two million mark.^{xxxviii}

In fiscal 2002-03 police attended 998,000 crime scenes and recovered biological material from approximately 100,000 of these. Of the 100,000 cases in which biological were recovered, approximately 57,000 DNA profiles were subsequently developed and loaded onto the database.^{xxxix} By contrast, during the same time period, police loaded DNA profiles from 405,000 suspects and/or arrestees onto the database. As a result of the combined number of profiles entered onto the database, 21,000 detections, or cold hits, were made.

Law Enforcement Training and Education Through the DNA Expansion Project

Two years ago, as part of the DNA Expansion Project, £3 million was allocated specifically to the education and training of every police officer in England and Wales. The training was developed with the FSS and was administered as an in-service program as officers came on shift.^{x1} Every officer received a lecture and CD-ROM. Given the extent to which DNA technology will only increase in its application to investigative work and given the turn over rates of officers, efforts are underway to repeat a similar program.

Results of the DNA Database Expansion Program

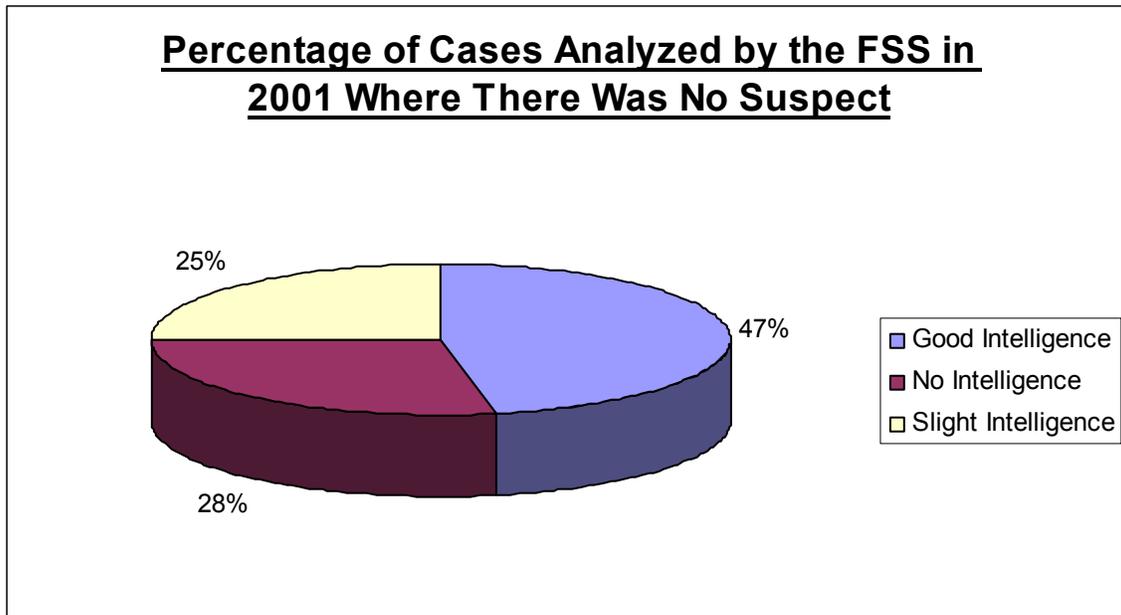
While their analysis is not yet completed, the Home Office has been able to identify a number of trends and statistics that demonstrate the effectiveness of using the DNA Database as an investigative tool for police. These include:

- In the National DNA Database, there is a 40 percent chance of obtaining a match between a crime scene profile and a Criminal Justice (suspect or arrestee) profile loaded on the database.
- 80 percent of the matches for criminal justice (arrestee or suspect) profiles, involved offenses different from the initial arrest or suspected offense.
- A growing number of matches involving serious crimes follow initial sampling for minor offenses.
- The detection or hit rate for domestic burglary increased from 14 to 44 percent when DNA was available at the crime scene.
- Each crime detected with DNA led to 0.8 other crimes being detected.
- The Home Office estimates that approximately 50 percent of the DNA database made detections led to convictions; 25 percent of those convictions led to custodial sentences.

- Each of the DNA based custodial sentences led to the prevention of 7.8 crimes.^{xli}

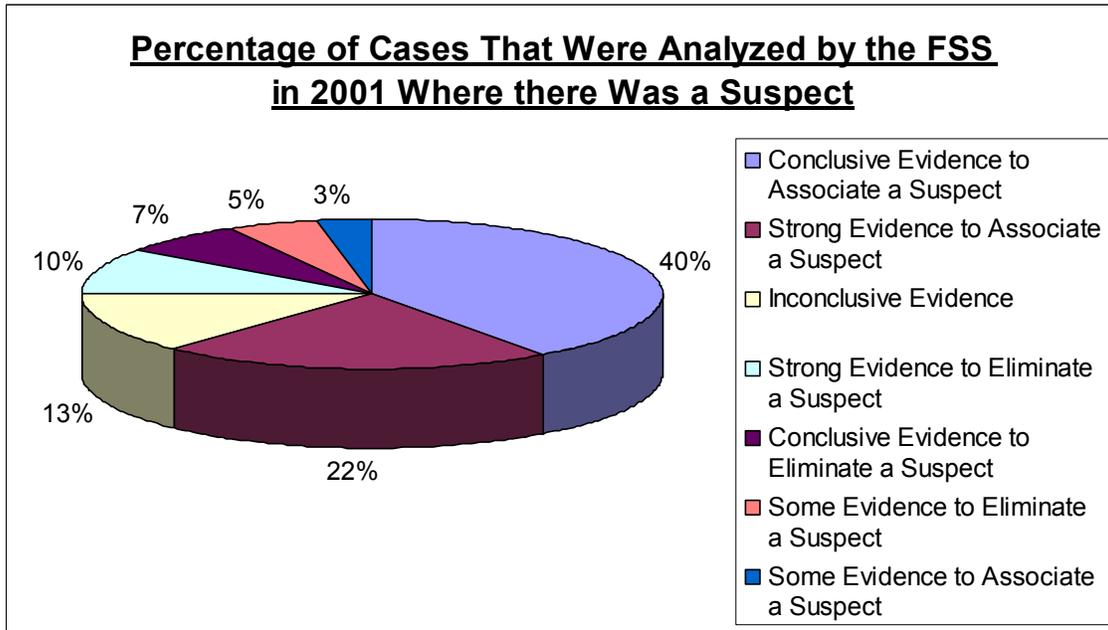
While in 1998-99, 41 percent of the cases analyzed by the FSS resulted in conclusive evidence to either associate or disassociate suspects with or from crimes, by 2001-02 that percentage increased to almost 50 percent (Exhibit 7). And for cases in which no suspect was known, 72 percent of forensic analysis demonstrated evidence of “some intelligence value.”^{xlii} However, the FSS suffers from the same problem identified in the United States in that the FSS does not normally receive feedback from the police and Crown Prosecution Service regarding the outcome of cases to which it has contributed (i.e.; convictions or acquittals). Thus, a significant portion of forensic analysis is not assessed as to its effectiveness on the outcome of criminal prosecutions.

Exhibit 7



xliii

Exhibit 8



xliv

Technology - Low Copy Number

The Forensic Science Service has pioneered a “super sensitive” form of DNA analysis called Low Copy Number or LCN. Using this technique, profiles can be developed “from very degraded material, very small stains and items that may contain skin cells such as jewelry or may have simply been touched by an offender.”^{xlv} Its foundational methods are based upon the AmpFLSTR® SGM Plus® PCR amplification kit but the added sensitivity of the technique is achieved by increasing the number of amplification cycles from 28 to 34 in the PCR reaction.

The significance of LCN is that it takes the advantages of PCR technology and the ability to develop profiles from small or degraded samples to another level. The technology enables profiles to be obtained from older crime scene evidence, smaller stains of blood and other body fluids as well as skins cells invisible to naked eye. As such, profiles can be developed from items which the offender has merely touched. This eliminates the necessity that he leave behind bodily fluids for DNA technology to be effective.

Therefore, the technology has the potential to open new offenses to the use of DNA as the primary investigation tool. Such cases might include auto thefts, which typically do not contain traditional forms of biological evidence such as hair or bodily fluid.

The first significant field trial for LCN technology was a pilot run through the West Midlands Police Department in 1999. The focus of the trial was the application of LCN to auto theft. Forensic Science Service “Intelligence Officers” were deployed to swab the areas of a stolen vehicle where minute biological samples, capable of LCN testing could be retrieved. It was found that areas such as the steering column and ignition box (areas most likely to be broken in an attempt to steal a vehicle) yielded the highest results in the analysis phase.

Low Copy Number technology however brings with it several concerns and is not currently being used in the United States. Two problematic issues arise when using the LCN technology: Secondary transfer and variable shedding.

- Secondary transfer refers to the fact that, through physical contact with other people, individuals can inadvertently carry and deposit other people’s DNA onto objects of evidence. For example, two people shaking hands will transfer their own DNA to each others’ hands. If each then goes on to touch another object such as a coffee mug, baseball bat, knife etc., they *could* transfer the other’s skin cells to the object. If that object is a murder weapon, the identification of DNA through LCN could prove problematic and misleading.
- Variable shedding refers to the extent to which different people shed their skin cells in different quantities under different circumstances. Some people are more likely than others to leave behind their DNA in the form of skin cells. Through research at the FSS, it has been found that there are, for example, “heavy shedders,” “medium shedders,” and “light shedders.” Thus, the last person to touch a particular object may not leave the most DNA or strongest profile.

- The amount of DNA deposited can also be affected by certain actions taken by the individual. Washing of one's hands will, for a period of time, decrease the amount of skin cells a person deposits on other objects. Additionally, the amount of perspiration exerted at the time the object is being held may also affect the amount of skin cells that are deposited. Both of these scenarios could adversely affect results upon LCN-DNA analysis.
- Given the nature of variable shedding and secondary transfer, the risk of obtaining a mixture is increased when applying a technology with increased sensitivity such as LCN. It is impossible to amplify the "right" DNA profile because all of the DNA that is contained in a biological evidence sample will be amplified.

The concerns associated with Low Copy Number DNA testing require a perceptive approach to crime scene processing and evidence collection. Where possible, objects most likely belonging to the perpetrator, (for example, tools left behind by a burglar), receive priority. Thus, in a burglary scene in which a screwdriver and a home owner's mug are found, both believed to be used by the offender, the screwdriver would take priority for testing. Similarly, when examining stolen vehicles, priority items for swabbing would include the steering column and ignition box because they are not often handled by the owner/driver, but often necessary to manipulate in order to steal a car.

Police Elimination Samples

Given the extensive use of DNA technology for all levels of criminal investigation, as well as the use of particularly sensitive LCN technology, police are now required to contribute a DNA sample for loading onto the database. While police officers employed prior to the sampling requirement could participate voluntarily, new recruits to the forces are mandated to contribute samples. To date, the NDNAD contains about 70,000 police elimination samples.^{xlvi}

Special Project

BRIL (Burglary Reduction Initiative in Leeds)

The BRL project targeted property crime, car theft and burglary in West Yorkshire. It was the largest crime reduction initiative in the UK between the years 2001 and 2002 and was funded through Home Office's Crime Reduction Program (£2.6 million). The program was designed specifically to reduce the incidence of burglary in the six Leeds Divisions of the West Yorkshire Police. While there were other components to the program such as crime prevention efforts, the DNA portion combined increased crime scene collection efforts by the police with rapid turn around time by the FSS. As a result of these efforts, suspect crime scene samples were processed, loaded onto the NDNAD, and matches reported to the police within 7 days or less. Importantly, police also agreed to act on the matches quickly.

The results to March 2002 showed:

- An almost four fold increase in the number of submissions to the FSS compared to the same period of time the previous year.
- 76 percent of crime scene submissions resulted in a profile being loaded onto the database.
- 69 percent of the profiles loaded onto the database produced a scene-to-scene or scene-to-suspect match.
- 79 arrests were made with 30 convictions made by March, 2002 (the remaining 49 cases are pending).
- Taking into account the offending patterns of some of those convicted, and based on the average value of goods stolen and property damage caused, just 16 of the rapid intelligence matches have lead to a savings of over 120,000.^{xlvii}

The Pathfinder Project

The Pathfinder Project was a partnership between the Forensic Science Service, the Lancashire Constabulary and Greater Manchester Police. It is also part of a broader Home Office Crime Reduction Program. Initiated February 2000 with a grant of £645,000 from the Home Office Targeted Policing Initiative, an additional £364,000 was awarded to continue the project for an entire year. The project's aim was to assess the value of forensic science in solving, prosecuting and ultimately reducing burglary and vehicle crime. DNA as well as fingerprints, footwear and tool marks were to be applied to volume crime as opposed to limiting the technology to the more familiar applications in violent crime scenes.

One of the specific goals of the project was to assess the effectiveness of Low Copy Number DNA analysis in improving the scope and quality of evidence recovered at crime scenes. Part of this assessment was the collection of LCN DNA swabs from burglary and vehicle crime scenes and trialing various potential areas for LCN DNA recovery. The project was also designed to assess the value of combining different forensic databases such as DNA, footwear, fingerprints and tool marks.

The first phase of the project, crime scene examinations, commenced in June 2000 and continued until May 2001. The intelligence linking aspect of the project continued until August 2001, with the evaluation and assessment phase being completed in December 2001. A training element was incorporated into the project to ensure a better understanding of forensic science and its potential to identify suspects. To assist in the identification of persistent and serial offenders, the FLINTs system from West Midlands Police was used. FLINTS is basically a computer system developed by West Midlands Police used to maximize the value of information collected by officers on a daily basis.

Contributions of LCN to the project

During the first 6 months of the project all LCN sampling was performed by FSS Examiners. During this period LCN samples were recovered from 51% of the crime scenes attended. In the second phase of the project crime scene examiners in Lancashire and GMP were trained to take samples. The recovery rate dropped to 12%. Thus, an overall recovery rate of 19% was achieved in LCN sampling. While more study would be required, the difference in recovery rates is a clear indicator of the value of crime scene specialists and/or the value of training to crime scene evidence recovery.

Tools were most commonly sampled from burglary scenes, while the most often sampled evidence from vehicles were ignition boxes and cowlings. Useable DNA profiles developed through the LCN process varied between 23% for screwdrivers and 8% for cowlings. It was noted however that the poor success rate for cowlings was influenced by the fact that the area of the cowling available for LCN sampling was minimized so as to ensure no loss of fingerprint detail. On average an overall success rate of 15% was achieved for all sample types.

Project results

While the evaluation of the project was designed to analyze the cost effectiveness of increased forensic activity (IE: the applications to burglary and vehicle crime) evaluators found it difficult to draw such conclusions. This difficulty arose from the fact that while Pathfinder was in operation, so were other programs such as the overall DNA expansion program. Thus it was difficult to distinguish between the ultimate effects of the two different initiatives.

One example of this issue can be seen in the fact that within the Pathfinder project divisions, 6% of the crime scenes examined yielded DNA (Not including LCN type samples). This represented a 73% increase in the number of samples recovered within the Pathfinder divisions during the project. However, within the non-Pathfinder divisions an increase of 45% was also observed over the same period.

A second example of this evaluation difficulty can be seen in the percentages of DNA samples leading to the identification of a suspect. In Pathfinder divisions, 44% of the DNA samples collected from the crime scenes identified a suspect. This represented a 57% increase in the number of DNA matches in those divisions. However, in the non-Pathfinder divisions a greater increase of 59% was observed. This seemingly incongruous result may be due to the number of arrestees sampled during the project. Data from Lancashire demonstrates that the CJ sampling rate was 30% higher in the non-Pathfinder divisions.

Overall, the forensic identifications within Pathfinder were predominately in the form of fingerprints at 61%. DNA accounted for 23%, LCN 12%, footwear 3% and tool marks 1%. Importantly though, it was found that the forensic identification was the first link to a suspect in 45% of cases. In a further 11% of identifications the suspect had already been identified but the evidence was weak. This suggests that forensic science was necessary in approximately 55% of cases. According to police, of the 55% of cases where forensic science was necessary to arrest and charge, officers considered that DNA (including LCN) evidence was essential in 90% of cases, fingerprints were essential in 77% of cases, footwear in 66% of cases and tool marks in 40% of cases.

Following the cases through to the courts, 88% of cases resulted in a conviction. Only 4% of cases went to trial and of these the outcome was a 50:50 split between a guilty verdict and acquittal.

(Note: Because there are no published evaluations of the Pathfinder Project, the information on Pathfinder was obtained through direct communication with officials at the Forensic Science Service)

Conclusion

DNA technology is used more effectively in England and Wales than elsewhere because it is no longer considered simply another forensic tool available to law enforcement. Rather, it is considered to be an integrated and routine part of the investigative process. It is not a technology to be used in special or particularly serious cases. It is a process invested in so as to become a routine part of every investigation in which biological material may be left by the perpetrator. Commitment to the use of DNA to solve volume crime and to the rapid analysis of crime scene evidence is key to this effort.

The progression of DNA databasing laws has helped that process by allowing police to utilize the profiles of individuals arrested or suspected of less serious crimes. Realizing that serious offenders commit less serious offenses too, the UK database laws take advantage of offender's likelihood to commit minor offenses. And realizing that offenders often commit more than one crime, allowing the use of suspect profiles empowers law enforcement to identify perpetrators sooner and to consolidate evidence and cases more effectively.

The Government has also followed up its expectations of the technology with the appropriate amount of funding. Not only is the technology funded well, but that funding is distributed wisely. By allocating the money directly to the law enforcement agencies themselves, they encourage the police to be thoughtful about their evidence collection and submission policies.

ⁱ Because of the way statistics are generated by the Forensic Science Service, this report focuses on the use of DNA technology in England and Wales. Statistics published and analyzed by the FSS include both countries. The statistics do not however, apply to the "United Kingdom" (England, Scotland, Wales and Northern Ireland) or to "Great Britain" (England, Scotland and Wales).

ⁱⁱ Home Office Science Policy Unit, *An Overview of the United Kingdom DNA Database*, United Kingdom, Home Office, 2002.

ⁱⁱⁱ Forensic Science Service.

^{iv} The Home Office is the government department responsible for internal affairs in England and Wales. It is analogous to the United States Department of Justice.

^v Werrett, David, Chief Executive, Forensic Science Service, interview, July 17, 2003.

^{vi} A population approximately equal to the states of Texas and California combined.

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- ^{vii} United Nations Office on Drugs and Crime Center for International Crime Prevention, *Seventh United Nations Survey of Crime Trends and Operations of Criminal Justice Systems*, 1998 – 2002: 117.
- ^{viii} Busher, Lesley, “The Use of the UK National DNA Database to Support an Intelligence Led Approach to the Investigation of Crime,” *Journal of Forensic Medicine*, 2002: 21 – 25.
- ^{ix} *Ibid.*, 21-25.
- ^x *Ibid.*, 21-25.
- ^{xi} The six were arrested in 1974. They had left Birmingham shortly before the bombs exploded in two city centre pubs in the bloodiest ever IRA attack. Twenty-one people were killed, more than 160 injured. The men claimed in court they had confessed only after being beaten by police. A new inquiry by Devon and Cornwall Police into the original inquiry uncovered irregularities in the police case against the Six. New scientific tests show statements made by the Birmingham Six were altered at a later date. Scientists also admitted in court that forensic tests which were originally said to confirm two of the six had been handling explosives could have produced the same results from handling cigarettes.
- ^{xii} Roberts, Paul and Chris Willmore, *The Royal Commission on Criminal Justice: The Role of Forensic Science Evidence in Criminal Proceedings*, London: Crown Copyright 1993.
- ^{xiii} There is no law actually establishing the National DNA Database. Rather the law allows for the collection and retention of the samples for police use. The model for the sample collection was the collection of fingerprints. This fact, more than any other contributed to the creation of the database as being populated by suspects rather than convicted offenders.
- ^{xiv} Johnson, Paul, Paul Martin and Robin Williams, “Genetics and Forensics: Making the National DNA Database,” submitted for publication to *Science Studies*, 2003.
- ^{xv} Police and Criminal Evidence Act.
- ^{xvi} Johnson, Paul, et al, “Genetics and Forensics: Making the National DNA Database,” submitted for publication to *Science Studies*, 2003:12.
- ^{xvii} *Ibid.*, 12.
- ^{xviii} *Ibid.*, 12.
- ^{xix} A Caution is the formal disposal of a criminal case without the intervention of prosecutors or the courts. About a third of all criminal cases resulting in a criminal record are disposed of by a police caution rather than by conviction. Cautions are kept on record and can influence future prosecution and court decisions.
- ^{xx} It should be noted that the changes were challenged as contravening the European Convention on Human Rights right to privacy. Ultimately, under a balancing test weighing public benefit against individual privacy, the European Convention issues were resolved in favor of benefits to public interest.
- ^{xxi} Werrett, David, Chief Executive, Forensic Science Service, interview, July 17, 2003.
- ^{xxii} On July 17, 2003 the Home Office issued, on its website, the Executive Summary of an Inspector’s report recommending the privatization of the Forensic Science Service as well as the creation of an independent governing board for the National DNA Database. If accepted, such changes would occur in approximately 18 months to two years. The Home Office has not yet stated whether or not it will implement the recommendations.
- ^{xxiii} Represents one fiscal year, from April 2001 through March 2002. Unless otherwise indicated, similar yearly references will represent one fiscal year.
- ^{xxiv} Comptroller and Auditor General HC 523 session 2002-2003, “Improving Service Delivery: The Forensic Science Service,” Comptroller and Auditor General, March, 28, 2003: 5.
- ^{xxv} NAO report March 2003
- ^{xxvi} A “recordable offence” is any offence which carries the possibility of a prison sentence.
- ^{xxvii} Criminal Justice & Public Order Act 1994 and Criminal Justice & Police Act 2001.
- ^{xxviii} Forensic Science Service, July 2003.
- ^{xxix} Forensic Science Service.
- ^{xxx} Forensic Science Service.
- ^{xxxi} Comptroller and Auditor General HC 523 session 2002-2003, “Improving Service Delivery: The Forensic Science Service,” Comptroller and Auditor General, March, 28, 2003: 15.
- ^{xxxii} Forensic Science Service, *Annual Report, 2001-02*, Forensic Science Service, 2002.
- ^{xxxiii} Comptroller and Auditor General HC 523 session 2002-2003, “Improving Service Delivery: The Forensic Science Service,” Comptroller and Auditor General, March, 28, 2003: 25.
- ^{xxxiv} There is the Chief police Officers Association to work on behalf of the members

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- ^{xxxv} Blakey, David, “Under the Microscope – Refocused : A revisit to the Investigative Use of DNA and Fingerprints,” HM Inspectorate of the Constabulary, June 2002: 1
- ^{xxxvi} *Ibid.*, 5.
- ^{xxxvii} Comptroller and Auditor General HC 523 session 2002-2003, “Improving Service Delivery: The Forensic Science Service,” Comptroller and Auditor General, March, 28, 2003: 14.
- ^{xxxviii} Bramley, Robert, Chief Scientist, Forensic Science Service, personal communication.
- ^{xxxix} Forensic Science Service.
- ^{xl} Werrett, David, Chief Executive, Forensic Science Service, personal communication.
- ^{xli} Forensic Science Service
- ^{xlii} Comptroller and Auditor General HC 523 session 2002-2003, “Improving Service Delivery: The Forensic Science Service,” Comptroller and Auditor General, March, 28, 2003: 6.
- ^{xliii} *Ibid.*, 32
- ^{xliv} *Ibid.*, 32
- ^{xlv} Forensic Science Service, Update, 1999.
- ^{xlvi} Bramley, Robert, Chief Scientist, Forensic Science Service, interview.
- ^{xlvii} Forensic Science Service, *Annual Report 2001-2002*, Forensic Science Service, 2002: 10.