The National DNA Database®

Annual Report 2002-03

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Foreword by the Home Secretary, David Blunkett

Home Secretary
David Blunkett

I very much welcome this, the inaugural Annual report of The National DNA Database®.

Since The National DNA Database® was established in 1995, it has grown rapidly, and particularly so since the inception of the Home Office DNA Expansion Programme in 1999. This year the two millionth individual profile was added to the Database, and by April 2004, it will contain DNA profiles of the whole known active criminal population in this country. Our investment in DNA technology means there is now a 40% chance of an immediate match between a scene of crime sample and a personal profile on the Database when profiles from new unsolved crime scenes are added. As a consequence it is now making a major contribution to crime prevention and detection, steadily increasing the number of offenders brought to justice and lifting the burden of suspicion from the innocent.

The use of genetic material is an emotive topic. People are naturally concerned to see that the handling and use of original genetic material, and the information derived from it, is carried out ethically and lawfully, and the DNA Database Board has recognised, in publishing this report, that public confidence is best served by transparency and openness. The report enables people to understand the workings and governance of the database and to satisfy themselves that it is being properly managed, delivering value for money.

The success of the database is very much a story of partnership between the Police Service, the Forensic Science Service and the Home Office. Together we have developed a world class crime intelligence tool, and we must ensure, through the Government's Police Science and Technology Strategy, that this country continues to stay at the cutting edge of applied forensic science.

David Blunkett

Introduction by the Chairman, David Coleman

Chief Constable
D F Coleman

I am delighted to introduce this, the first Annual Report of The National DNA Database® Board. Its publication represents part of a process of significant change and development for the Database in the immediate future.

Since The National DNA Database® was set up in 1995 under the legal framework provided by the Criminal Justice and Public Order Act 1994, it has been overseen by a Management Board operated under a Memorandum of Understanding between the Forensic Science Service (FSS) and the Association of Chief Police Officers (ACPO). Recent developments, including the Home Office DNA Expansion Programme, the Review of the Forensic Science Service, and the the Human Genetics Commission Report "Inside Information" have combined to provide drivers for change in this approach. As a result, The Board has recently welcomed representatives of the Home Office and the HGC into its ranks, and we are already seeing the benefit of their wider perspective and joint leadership as we discuss future developments.

Since its inception the database has been operated by the Database Custodian, an arm of the Forensic Science Service managed by the FSS Chief Scientist. The Board will soon need to manage significant change; as the status of the Database Custodian is likely to change following the FSS review; as we seek to ensure the financial security of the Database in the future; and as we try to ensure the integration of DNA intelligence with other national intelligence databases. It is already clear that the Database is capable of making a huge contribution to the detection and prevention of crime in the United Kingdom, and has become a strategic national intelligence asset, alongside the PNC and the National Automated Fingerprint Identification System. As such it must be maintained and developed on a secure footing for the benefit of current and future law enforcement personnel, and the public. The high public profile of DNA is demonstrated by the level of media attention that it constantly receives. Even after a period as short as eighth years, it is hard now to imagine a future in crime investigation without the contribution made by DNA evidence. We believe that this contribution will be even greater in the future as technology, and our understanding of the science develops.

The Board recognises that in order to ensure continued public confidence in DNA evidence, the workings and governance of the Database need to be carried out in an atmosphere of transparency, openness, and the availability of appropriate information to the public. There are many myths surrounding DNA evidence, and I hope this report will dispel many of them. I believe that the report amply demonstrates that we set and maintain high ethical and quality standards, and constantly strive to protect the integrity of DNA evidence by exercising strong management oversight of DNA processes.

It would be remiss of me to end this introduction without paying tribute to all of the scientists, police officers and government officials who have made possible the success of the Database thus far, and particularly to Dr. Bob Bramley, the Database Custodian, whose knowledge, experience and wise counsel have been so valuable to me in my role as Chairman. I thank them all sincerely.

Section1: DNA Profiling and The National DNA Database®

Overview

The National DNA Database® is a police intelligence database for identifying possible suspects for offences, and possible links between offences, by means of DNA analysis. Since the Database was first established in 1995, The Forensic Science Service® has been appointed by the Association of Chief Police Officers (ACPO) as Custodian.

DNA is deoxyribonucleic acid. It is found in virtually every cell in the body and carries genetic information from one generation to the next. Within the DNA is carried the genetic information that determines our physical characteristics and directs all the chemical processes in the body. Half our DNA is inherited from our mother and half from our father. Except for identical siblings, each person's DNA is unique.

The technology used to obtain DNA profiles for The National DNA Database® does not examine every single difference between people's DNA. It is restricted to looking at only specific areas of the DNA, known as short tandem repeats (STR's). STR's are known to vary widely between people by virtue of variations in their length, and thus are extremely useful for identification purposes. However, the STR's are found only in the non-coding region of DNA and therefore provide no information of genetic significance, about an individual's genetic predisposition to a medical condition for example. It is important to recognise that The National DNA Database® is not a genetic database.

The DNA technology used in forensic science has evolved enormously since DNA was first used in 1987. To begin with, DNA analysis techniques did not look at the STR areas of DNA, and were not suitable for databasing. The first STR technique, introduced in 1994, looked at only 4 STR areas. The next development, using SGM (second generation multiplex) profiling, looked at 6 STRs and the present-day technology, known as SGM Plus™, looks at 10 STRs. A gender marker, known as Amelogenin, is also determined. For each STR there are 2 alleles or markers, 1 from the individual's mother and 1 from their father. A full DNA profile for The National DNA Database® thus contains 20 markers and the gender marker.

SGM Plus™ profiling is very discriminating. The probability of obtaining a match between the profiles of two unrelated individuals just by chance when two full profiles are involved is very low, of the order of 1 in 1 billion. Where fewer than 20 markers have been determined, from degraded samples from scenes of crime for example, the level of discrimination is reduced accordingly.

Present day STR technology is also very sensitive. DNA profiles can now be obtained from trace quantities of biological material that are invisible to the naked eye recovered from crime scenes.

Legislative Background

The Police and Criminal Evidence Act 1984 (PACE) sets out the circumstances in which samples can be taken from a suspect for use in connection with the investigation of an offence. These are termed 'evidential samples'. PACE also distinguishes between intimate and non-intimate samples.

Criminal Justice and Public Order Act 1994 (CJPOA)

The CJPOA made several amendments to PACE to extend the circumstances in which samples may be taken from a person for the purpose of DNA profiling.

The CJPOA allowed an intimate sample to be taken from a person in police detention, with the person's consent, where an officer of at least the rank of superintendent had reasonable grounds for suspecting the involvement of that person in a recordable offence. Recordable offences represent the majority of crimes that the police investigate. Broadly, they are offences that could lead to a custodial sentence. Prior to this amendment intimate samples could only be taken in respect of serious arrestable offences.

The CJPOA allowed a non-intimate sample to be taken without consent from a person in police detention or a person being held in custody on the authority of a court where an officer of at least the rank of superintendent had reasonable grounds for suspecting the involvement of that person in a recordable offence, or without consent if the person has been charged with a recordable offence or informed that he or she will be reported for such an offence. These are termed 'Criminal Justice' or 'CJ' samples. Saliva, swabs from the mouth and hair with roots were re-classified as non-intimate samples. The vast majority of CJ samples taken by the police are mouth swabs.

The CJPOA also allowed information derived from samples to be checked against existing records in a speculative search (a search to see if the person has been involved in another, as yet, unsolved, offence), provided that, before the sample is taken, the person is told the reason why it is being taken and that it may be used for a speculative search. This allowed DNA profiles to be checked against other DNA profiles derived from materials from undetected crimes ('SOC' samples).

If a sample proved insufficient or unsuitable for analysis, the CJPOA allowed for a second sample to be obtained. But the samples and the information derived from them had to be destroyed if the individual they related to was not prosecuted or was acquitted.

The Criminal Justice and Police Act 2001 (CJPA)

The CJPA allowed samples from persons who were not prosecuted or who were acquitted, and the information derived from them, to be retained, providing the samples had been lawfully obtained in the first instance.

This legislation has been subject to legal challenge in the cases of R v S and Marper on the basis of a violation of the appellants' human rights. However, the provision of the CJPA allowing retention of DNA profiles on the Database was upheld in the Divisional Court following Judicial Review proceedings in 2001, and then in the Court of Appeal during 2002. The appellants have since been granted leave to appeal to the House of Lords. It is anticipated that the outcome of this appeal will be known in 2004.

A further provision of the CJPA allowed persons who voluntarily provide samples for DNA profiling (e.g. to assist with an intelligence-led DNA screen in a murder enquiry) to give consent for the retention of their profiles on The National DNA Database® and for these to be speculatively searched against SOC sample profiles. Once consent is given it cannot then be withdrawn. The main benefits of this development are to reduce the cost of re-sampling individuals and to increase the rate of growth of the National DNA Database.

The CJPA further allowed the police to re-take samples for DNA analysis when laboratory analysis of the first sample failed, and reduced rank authorities from superintendent to inspector.

Criminal Justice Bill

Proposals for further legislative changes are currently before Parliament in the form of the Criminal Justice Bill. These would amend PACE by extending the powers of the police to take a sample for DNA analysis from a suspect in police detention, following arrest for a recordable offence.

Public Confidence

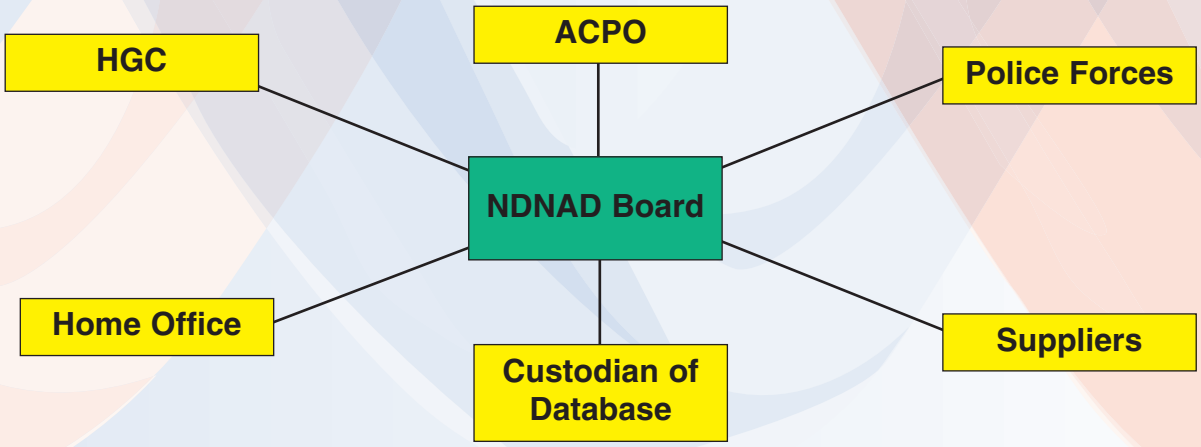
The use of DNA profiling and DNA databases has made a valuable contribution worldwide to the investigation of crime and the detection and prosecution of offenders. The National DNA Database® Board fully recognises the importance of the highest possible scientific standards being applied to ensure the validity of the DNA profile records and its part in ensuring that these are used responsibly with due regard to the sensitive nature of the personal information involved. The publication of this first Annual Report is intended to provide the public with a wide range of information to enable people to make informed judgements about the use of the Database.

Section 2: Management of The National DNA Database®

The roles of The National DNA Database® Board, the police, the DNA profiling laboratories and the Custodian of The National DNA Database® are set out within a Memorandum of Understanding (MoU) between the Forensic Science Service (FSS) and the Association of Chief Police Officers (ACPO).

The National DNA Database® Board

The National DNA Database® Board is responsible for managing the MoU and for overseeing the efficiency and effectiveness of The National DNA Database® as a tool for the provision of intelligence to support the investigation, detection and reduction of crime. The Board meets quarterly and reviews and evaluates matters of policy, legislation and performance. It is chaired by the ACPO lead on Forensic Science, currently the Chief Constable of Derbyshire Constabulary, and includes the Custodian and representatives from police regions, the Home Office, the National Crime and Operations Faculty and the FSS as the principal supplier of DNA profiling services to the police. In recognition of the increasing public interest in the use of DNA and genetic information in general, the Board has recently been joined by a new independent representative, Mr. Philip Webb, nominated by the Human Genetics Commission (HGC).



The Police

During the course of their enquiries, the police take CJ and evidential samples using kits approved by the Custodian, and are responsible for creating a record on the Police National Computer (PNC) showing that a DNA sample has been taken. Each DNA sampling kit is identified by a unique barcode number. The police also retrieve DNA evidence (SOC samples) from unsolved scenes of crime. The CJ and evidential samples and the SOC samples are submitted by the police to an approved DNA profiling laboratory for analysis.

The DNA Profiling Laboratories

There are currently five organisations approved to carry out DNA analysis for supply of profiles to The National DNA Database®: Cellmark; the FSS; LGC Limited; and the Strathclyde and Tayside Police laboratories in Scotland.

These organisations are also responsible for the secure retention of the DNA samples on behalf of individual police forces and for their destruction when no longer required. The Custodian requires that the samples be kept in a managed storage system at a temperature below -15°C, and in compliance with the requirements of the ISO 17025 quality standard and the Data Protection Act 1998.

A proposal to convert to an alternative sampling regime (ATS) that would allow the samples to be stored at ambient temperature was considered by ACPO and the Custodian during the course of 2002 in collaboration with supplier laboratories and police forces. A decision was made on cost/benefit grounds not to move to ATS at the present time, although it was agreed that the option should be kept under review for reconsideration should the cost/benefit balance improve.

The Custodian

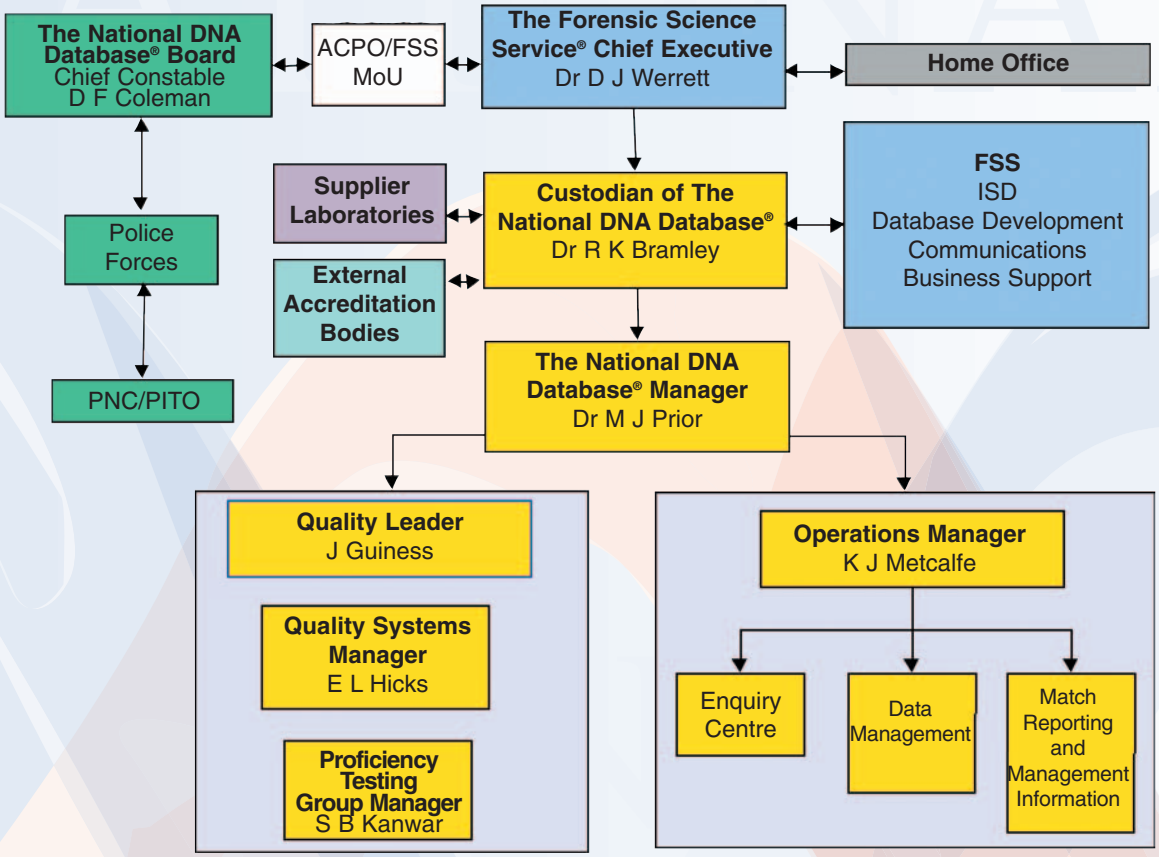
The FSS provides and maintains the IT infrastructure for The National DNA Database® and acts as Custodian of the Database through its Chief Scientist, Dr Bob Bramley.


Dr R K Bramley

The Custodian ensures the highest standards of integrity in the management of The National DNA Database® and establishes the protocols, procedures and standards of performance required to ensure the reliability, compatibility and legality of all data held on the Database. He sets the quality standards for laboratories that supply DNA profiles to the Database, and monitors supplier performance against these standards. The Custodian also provides intelligence information to the police about Database matches between profiles from individuals and material from unsolved crimes, an enquiry service for police forces and other customers, and management information on the use of the Database and the provision of Custodian services.

Developing collaborative relationships between these groups is vital, given the ever-increasing importance of the Database as a crime fighting tool, the growing interdependency of business processes, and the continuing high level of Government investment in expanding the Database.

The Custodian's relationships with The National DNA Database® Board and other key stakeholders are illustrated below:



A key initiative to develop Custodian/supplier relationships during the year has been the establishment of Service Level Agreements (SLA's). As well as giving more clarity on the requirements of both parties, the SLA's have led to the establishment of regular meetings between the Custodian and individual suppliers, and discussion of mutually important issues has proved to be a valuable driver for continuous improvement on both sides of the relationship.

Closer ties and regular meetings have also been established with the United Kingdom Accreditation Service (UKAS). The supplier laboratories and the Custodian are accredited by UKAS to the international quality standard ISO 17025, and UKAS audit the supplier laboratories and the Custodian to monitor compliance with this standard. On behalf of the Custodian, UKAS also monitor the compliance of the supplier laboratories with more specific quality standards set by the Custodian.

Monthly meetings are held at local FSS laboratories between the Custodian, suppliers and PNC bureau and submission staff from forces responsible for submitting samples for DNA profiling. These provide an opportunity for forces to receive updates and information relating to all aspects of DNA utilisation and The National DNA Database®.

Section 3: The National DNA Database® Records

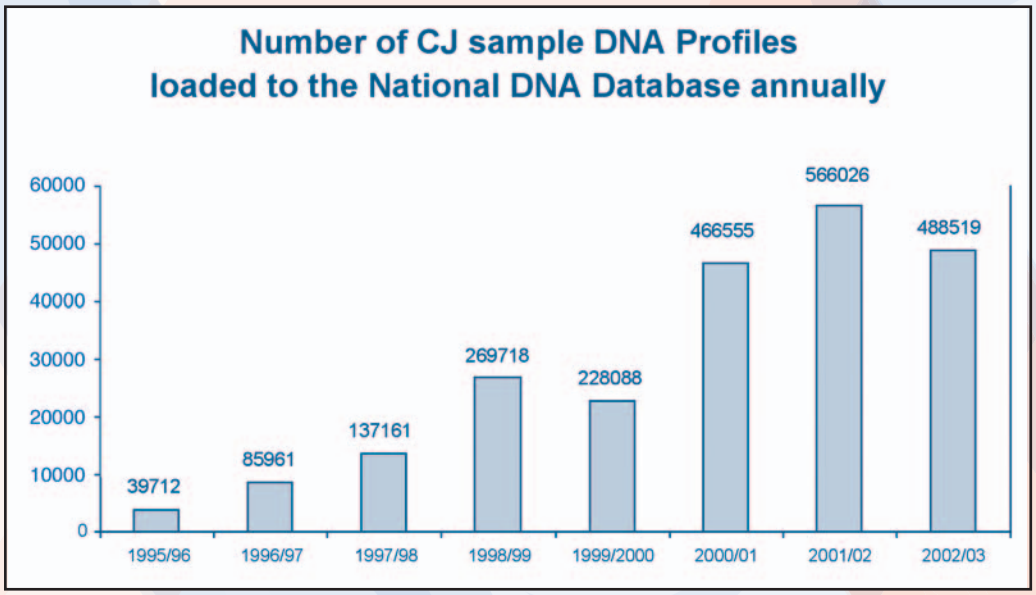
Statistics

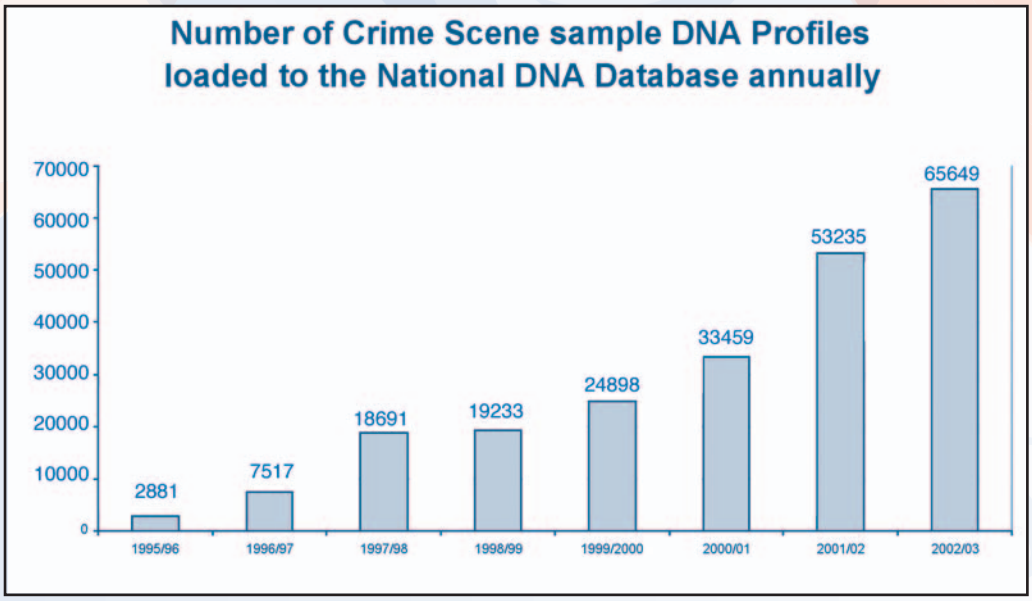
On 31 March 2003, The National DNA Database® held

- 2,099,964 CJ sample records
- 1,182 evidential sample records
- 193,138 SOC sample records

Over the 2002/03 financial year:

- 488,519 new CJ sample records were added. This equates to 86% of the total that were loaded in 2001/02
- 65,649 new SOC sample records were added. This equates to 123% of the total that were loaded in 2001/02





CJ Sample Records

Each CJ sample record on The National DNA Database® is identified by means of two unique numbers. First, there is the barcode number supplied with the kits used by the police to take the samples; second, the Arrest Summons Number (ASN) obtained when the PNC entry is created. In addition to these two numbers, a CJ sample record also contains details of the person's name; date of birth; ethnic appearance code; gender code; information relating to the sampling force and the supplier laboratory to which the sample was submitted; the sample type; the test type; and the DNA profile. All of the sample details are transferred to The National DNA Database® from PNC, at the time the PNC record is created by the Police. The DNA profile information is supplied to the Database later by the supplier laboratory. The DNA profile will only load successfully if the accompanying kit barcode and ASN numbers match those that were previously transferred from PNC.

Load failures are always investigated and corrective action taken to enable loading of the DNA profile. Investigation of such situations shows that the cause of the initial load failure is invariably keyboard data entry error and /or mis-reading of hand written information. To address this, the Custodian is working with the Police Information Technology Organisation (PITO) to develop a future system in which all of the data entry will be via barcode scanning.

The number of CJ sample records on the Database is not the same as the number of separate individuals for whom DNA profiles have been obtained. This is because there is some replication. The level of this has been estimated at around 10%. The link between the Police National Computer (PNC) and the Database, which was implemented in November 2001, is proving to be a valuable means of reducing this replication, as it now allows the police to identify through PNC whether a sample has previously been taken for DNA profiling and whether a profile has been successfully obtained. Some replication will always occur as many criminals use aliases to disguise their identity, so before deciding whether to take a further sample for DNA analysis, it is now good practice for the police first to carry out a fingerprint check to confirm the individual's identity using the National Automated Fingerprint Identification System (NAFIS), then to check on PNC whether the individual's DNA record is already on the Database.

However, because the PNC link was not operational through the early years of the National DNA Database®, a proportion of the older records on the Database do not have corresponding records on PNC. There is also currently no link between the PNC and Scottish forces. It is therefore not always possible for the police to use this approach to check whether the DNA profile has been obtained, although work is planned to bring as many of these records as possible into line with PNC as a means of further reducing replication.

SOC Sample Records

Each SOC sample record is also identified by a unique barcode number (provided by the Custodian for use by the supplier laboratories). It contains details of the offence code; information relating to the sampling force and the supplier laboratory to which the sample was submitted; the sample type; the test type; and the DNA profile. This information is all transferred to The National DNA Database® direct by the supplier laboratory.

Homogeneity of Records

The DNA profiles on The National DNA Database® are not homogeneous. Profiles obtained between 1995-1999 were based on the SGM profiling system and those since 1999 on SGM Plus™. The SGM system analyses 12 short tandem repeat (STR) markers and the Amelogenin gender marker. SGM Plus™ analyses the same SGM markers together with an additional 8 STR markers. All CJ sample profiles are either full SGM or full SGM Plus™ profiles but SOC sample profiles can be partial ones, and must contain a minimum of 8 of the STR markers.

The distribution of the different types of profile on The National DNA Database® on 31 March 2003 was

CJ sample profiles:	SOC sample profiles:
590,000 (27%) SGM	46,000 (23%) SGM
1,578,000 (73%) SGM Plus	154,000 (77%) SGM Plus
	22,849 (11%) partial

Section 4: Identifying Matches

When a new CJ sample profile is added to The National DNA Database® it is checked against all SOC sample profiles on the Database. When a new SOC sample profile is added to the Database it is checked against all CJ and SOC sample records. Any that are compatible are reported as a match.

Prior to 2001, matches were counted on the basis of these pairwise comparisons. This did not, however, relate in any meaningful way to the number of detections being reported by the police based on their use of The National DNA Database®. A new way of counting matches involving CJ sample profiles was therefore introduced this year, based on the number of scenes for which one or more suspects was nominated. This provides a much more accurate reflection of the potential number of offences which could be detected by the police, and a more meaningful indicator of the effectiveness of the Database.

"Pairwise": profile to profile matches - since April 1995:

- CJ to SOC : 354,370
- SOC to SOC : 23,191

"Scene focussed": crime scenes for which one or more suspects have been identified

- since May 2001: 94,373 (cf. 316,999 "pairwise")

- including: serious crime offences 4,632
  volume crime offences 89,741

In 2002/03, based on the new way of counting, 43,904 scenes were associated with one or more suspects. This represents a 36% increase on the previous year.

One-off Speculative Searches

There are strict criteria for the quality of profiles that can be loaded to The National DNA Database®. Where profiles do not meet these criteria they can still be checked against the Database without being loaded. This is usually only a practicable proposition, however, in cases involving serious crime. In 2002/2003, 1,394 such one-off speculative searches were carried out. This compares with 1,559 in the previous year. The outcome of these searches is often a large list of potential matches which are then passed to the supplier laboratories for further investigation.

A similar one-off speculative search approach is used for conducting familial searches of the Database to identify offenders through possible relatives. An example of the use of this approach is given under Special Initiatives in section 7.

Adventitious Matches

The probability of a match between two full SGM Plus™ DNA profiles from unrelated individuals is less than 1 in 1 billion and the match probability between two SGM profiles from unrelated individuals is about 1 in 50 million. The probability of a match increases if the profiles are partial, or the individuals are related.

Where a match between two profiles occurs just by chance, rather than because the profiles relate to the same individual, it is termed an adventitious or chance match. Given the match probability and the expected growth in size of the National DNA Database, adventitious matches between full SGM Plus profiles are extremely unlikely to occur. It has been estimated that there should be no more than more one or two in the next 5 years.

Full SGM Plus™ matches are in fact being seen more frequently than would be expected on the basis of this forecast. If these were truly adventitious matches, the underlying theory behind the interpretation of DNA evidence would be seriously undermined. It is thus essential that they are always fully investigated and a policy has been agreed that in these circumstances the police, supplier laboratory and Custodian will always consider whether:

- the individuals identified are in fact the same person, who has been sampled more than once
- the individuals are close siblings
- there have been sampling handling or data transposition errors by the Force
- there have been sample handling or data transposition errors by the supplier(s)
- there have been data transposition errors by the Custodian

Only when all these can be eliminated will the match be classified as adventitious. Thus far, no true adventitious matches involving only full SGM Plus™ profiles have been identified.

Adventitious matches involving partial profiles are more likely to occur, and will be seen more frequently as the size of the Database grows. It is always advantageous with such partial profile matches to consider further work to obtain fuller profiles as part of the police investigation. The extent to which this is necessary will depend on what other evidence is available.

Section 5: Security, Scientific Standards and Quality Management

Security

The National DNA Database® is managed strictly in compliance with the requirements of the Data Protection Act 1998 and Government IT security guidelines. Systems are in place to ensure that access to the information is tightly controlled and the information is used only for the purposes specified in the legislation of assisting the police with the prevention and detection of crime, the investigation of any offence or the conduct of a prosecution.

Scientific Standards and Quality Management

Standards

The Custodian sets the performance standards required of suppliers and these are fully documented in the Custodian's Quality Management System (QMS). The standards meet the recommendations of the DNA Working Group of the European Network of Forensic Science Institutes and the QMS has been accredited by the United Kingdom Accreditation Service (UKAS) as compliant with the international quality standard ISO 17025.

Custodian: Audit and Assurance

The Custodian is subject to a range of independent audits. Collectively these provide assurance that the operation of The National DNA Database® is compliant with the standards. They include internal audit against the individual quality procedures which constitute the Custodian's QMS; systems audit by Home Office Internal Audit; external audit by BSI.QA in relation to Custodian Services; and external audit by UKAS in relation to the Custodian's Proficiency Testing Group.

A detailed account of DNA profiling and use of The National DNA Database® was presented to assist the Court of Appeal in the case of R v S and Marper in relation to retention of profiles when persons are not prosecuted or are acquitted (see under section 1 *Legislative Background*). The appeal was dismissed.

The Human Genetics Commission (HGC) has also looked at The National DNA Database® as part of its work on the 2002 report: 'Inside information – balancing interests in the use of personal genetic data'. An end-to-end review of the FSS led by Robert McFarland was asked to take account of the findings of the HGC in relationship to Custodianship of The National DNA Database® and to make recommendations. It is expected that these recommendations will be considered by the Home Office, ACPO and the FSS later this year.

Suppliers: Accreditation

The Custodian is accountable to The National DNA Database® Board for the accreditation of laboratories to supply profiles to the Database. To become accredited, prospective suppliers must satisfy UKAS that they can meet the requirements of ISO 17025 and the additional requirements of the Custodian set out in the UKAS document LAB 32. They must also demonstrate through satisfactory completion of proficiency tests provided by the Custodian that they can consistently produce DNA profiles that are reliable and compatible with those provided by other suppliers to the Database.

Suppliers: Performance Monitoring

Assurance that suppliers continue to meet the required standards is obtained through a programme of internal and external quality audit by UKAS, the duplicate analysis of 5-10% of all their CJ samples and their on-going participation in a programme of declared and undeclared proficiency tests provided by the Custodian. During 2002, the Custodian's Proficiency Testing Group gained accreditation for provision of this programme to the new international quality standard ISO/IEC 43.

Error Identification and Investigation

The consequence of having erroneous records on the Database is that the police may be misled in their investigations, an offender may go undetected and an innocent person may wrongly fall under suspicion. A great deal of effort is therefore made to minimise this risk.

The Custodian routinely carries out systematic analysis of the records held on the Database to identify irregularities within the data held. These include, for example, gender anomalies (where the recorded gender and the result of the Amelogenin (gender marker) test are different) and impossible dates of birth.

The Custodian also checks for profiles that would have given rise to matches but for 1 DNA marker in the profile being different. The probability of finding such a near match just by chance is usually very small. It is far more likely to be due to an error in designation of one of the profiles.

All these types of error are investigated further by the Custodian or supplier laboratory, as appropriate, and corrective action is taken. The Custodian is responsible for ensuring that the corrective actions fully address all the issues and that they are implemented. In some circumstances this will include consideration of the error being such that it could have wider implications.

An analysis of the causes of erroneous records on the Database for CJ samples has shown them to be due to:

- incorrect data recording at the time of sampling by the police;
- transposition of samples, or the information relating to samples during analysis, mis-identification of the STR markers in the DNA profile or mis-recording of profile data by supplier laboratories; or
- clerical mistakes by the Custodian when amending/deleting profiles on the Database.

For SOC samples, the causes of error tend to be similar, although some profiles can also be affected by contributions from DNA unrelated to the offender.

A number of recent developments will contribute significantly towards eliminating these causes and reducing the incidence of erroneous records on the Database. The link between PNC and the National DNA Database for downloading the demographic data from PNC to the Database and replacement of manual data recording and transcription by electronic methods will help eliminate data recording/transcription errors. The use of Laboratory Information Management Systems (LIMS) and automated analytical processes will reduce sample handling errors. The development of expert systems for interpreting the analytical data and determining the DNA profiles will reduce the risk of errors in determining the DNA profile. And improvements in the prevention and early detection of extraneous DNA will result in fewer instances of contaminated SOC sample profiles.

It is important also to recognise that it is extremely unlikely that erroneous records on the Database would lead to a wrongful prosecution or conviction. This is because the police have to take a new sample from the suspect for use in evidence, and the possibility that this will match the erroneous profile, just by chance, is virtually negligible.

It is widely recognised that the technology currently available does not allow the examination of every single difference between people. The techniques used look only at specific regions of DNA which are known to vary widely between different individuals. Therefore, scientists are unable to say with complete certainty that DNA from a crime scene sample has originated from a person whose DNA profile is found to match. All they can say is that there is (usually) a very high probability that the DNA originated from the individual rather than an unrelated person. DNA evidence on its own is thus compelling, but not conclusive, and the courts will require independent corroborative evidence to indicate involvement of the suspect in the crime.

Contamination

Current DNA profiling methods are very sensitive. It is routinely possible to detect very low levels of DNA, equivalent to approximately 50 cells, and it is even possible to detect the DNA present in a single cell, although in practice several cells are commonly required.

Because of this very high sensitivity, there is an increased chance of detecting DNA from more than one person in samples. This may be background DNA which is ubiquitous in the environment and cannot be avoided, but only usually becomes an issue when analysing traces that are invisible to the naked eye. It may also be DNA deposited inadvertently by persons attending the scene after an incident has occurred or collecting samples for analysis; or DNA shed by scientists involved in the analysis of the samples or by persons involved in production of the materials used in the analytical process; or DNA accidentally transferred from one item to another. DNA from these sources is referred to as contamination.

Contamination is easily detected in CJ and evidential samples and will preclude the profile from being loaded to the Database. It is less easy to detect in a DNA profile from a SOC sample and can adversely affect the ability of a laboratory to interpret a DNA profile from a SOC sample.

Many precautions are taken to reduce the risk of contamination. The Custodian has provided guidelines for the "Avoidance of Contamination in the Recovery, Packaging and Submission of Material for DNA Analysis" by police personnel investigating crimes and standard sampling kits are provided for use by the police in taking samples from suspects, victims and volunteers. Anti-contamination measures are also an integral part of the quality standards that supplier laboratories are required to adhere to. These have become increasingly important given the now very highly sensitive techniques used for DNA profiling. The supplier laboratories also carry out quality control of their consumables and reject any that are unacceptable.

Nevertheless, inadvertent transfer of DNA will occur on some occasions and the laboratories have a range of systems in place to detect it.

To help identify contamination by police personnel, a Police Elimination Database (PED) has been established. Profiles from named individuals on this database are checked against a specific crime sample profile when the Senior Investigating Officer or Scientific Support Manager of the force feels contamination by that individual could have occurred. Supplier laboratories have established elimination databases to help detect contamination from their staff.

Supplier laboratories also have quality control checks in place to identify cross-contamination between different samples and systematic contamination from the equipment and consumable materials used for DNA analysis.

When contamination is detected it is sometimes possible to re-analyse the sample to provide a valid result. In other circumstances, if the source of the contamination is known (e.g. the DNA analyst), it may be possible to derive a valid result by taking account of the contamination. If neither of these is possible, the result obtained is deemed invalid.

Section 6: Home Office DNA Expansion Programme

The Home Office has invested £182 million between April 2000 - March 2004 with the aim of increasing the number of CJ and SOC sample profiles on the National DNA Database®, to include all known active offenders. It is anticipated that there will be approximately 2.4 million individuals represented on the Database by 31 March 2004. A DNA Expansion Programme Board, chaired by the Home Office, oversees the allocation of this funding and monitors its effective use. To date, the funding has provided for the taking, processing and loading of CJ and SOC samples to the Database, the employment by the police of the necessary associated support personnel and equipment, and establishment of the DNA Liaison Panel meetings.

Custodian IT Development

The DNA Expansion Programme Board also provided £2.4 million to the Custodian for further developing the National DNA Database® IT systems and the means of meeting the operational services and information requirements of stakeholders. The Custodian was heavily supported by the FSS Research and Development Group and Information Services Department in this work.

A major element of the Custodian IT development programme was the introduction of new servers and software for the Database. These were successfully brought on line in February 2003 and represent the biggest technical improvement to the Database since it was established in 1995. They provide for the increased capacity needed to deal with current and future usage of the Database and give a major improvement in the day to day speed of searching for matches. They have also provided a major enhancement to the operational robustness of the Database and the services provided from it. Furthermore, the new servers will enable further improvements to the Database and the service it provides that would not have been possible under the previous technology. An example of the work currently in hand is delivery of DNA match reports to forces electronically, to replace the existing paper-based arrangements. The new system, which is currently being piloted with West Midlands Police, will speed up the information flow and enable forces to combine DNA information seamlessly with other forms of police intelligence.

A number of key Custodian issues remain to be addressed, however. These include streamlining of the systems for loading DNA profiles, to reduce the potential for replicate profiles and speed up the loading process. The Home Office has been approached to provide funding for this and other development work for 2003/2004.

Management Information

The information requirements of stakeholders were clarified and agreed during the latter part of 2002, in conjunction with the Home Office and The National DNA Database® Board, and a new portfolio of National DNA Database management information reports was developed. These included reports based on the revised way of counting matches (i.e. having the potential to assist the police to obtain detections) which have become very important in terms of demonstrating to the Programme Board the value of utilisation of DNA in criminal investigations.

Section 7: Performance in the Provision of Custodian Services

Custodian Key Performance Indicators

The National DNA Database® Board set 3 key performance indicators (KPIs) for the Custodian during the 2002/03 financial year:

- All DNA profiles for The National DNA Database® and PED will be loaded within 24 working hours of their receipt by the Custodian

Performance Indicator	**1**	All DNA profiles for The National DNA Database® and PED will be loaded within 24 working hours of their receipt by the Custodian.

Performance against target			
Q1	**Q2**	**Q3**	**Q4**
90.7%	**94.8%**	**93.1%**	**94.4%**

Note: Profiles which were not loaded within 24 hours are those which failed to load when presented to the Database. In the main, load failures were due to police data input errors.

- 90% of match reports for all cases will be dispatched without validation of the match within 1 working day of loading the relevant profile to The National DNA Database® and the remaining 10% will be dispatched within 3 working days. All match reports involving violent crime will be dispatched on the same day that the match is identified.

Performance Indicator	**2**	a) 90% of match reports for all cases will be dispatched within 1 working day of loading the relevant profile to the Database. b) The remaining 10% will be dispatched within 3 working days. c) All match reports involving violent crime will be dispatched on the same day that the match is identified.

Performance against target				
	Q1	**Q2**	**Q3**	**Q4**
a) % matches reported within 1 working day	**97.3%**	**96.6%**	**96.7%**	**98.3%**
b) time to report remaining matches	**4 to 86 days**	**4 to 81 days**	**3 to 66 days**	**3 to 77 days**
c) % match reports in violent crime cases dispatched on same day	**100%**	**100%**	**100%**	**100%**

Note: Matches that were not dispatched within 1 working day of loading the profile are those where scientific checks were needed by the supplier laboratory. The time taken for reporting the matches reflects the time taken by the supplier laboratory to carry out the checks.

- Following verification, should the profile result differ from that originally reported, an elimination report will be dispatched within 1 working day of receipt of the verification result.

Performance Indicator	3	Following verification, should the profile result differ from that originally reported, an elimination report will be dispatched within 1 working day of receipt of the verification result.

Performance against target

	Q1	Q2	Q3	Q4
Number of elimination reports dispatched within 1 working day	14 out of 15	109 out of 130	312 out of 405	170 out of 275
Time for dispatch of the remaining elimination reports	3 days	3 to 5 days	3 to 12 days	3 to 10 days

Special Initiatives

One of the Government's objectives is to reduce the time it takes to bring offenders to justice. The early identification of offenders and the rapid linking of series offences is most valuable to the investigating officer as offences are more likely to be detected and either stolen property recovered or further offences prevented. The rapid processing of DNA crime stains by supplier laboratories and the subsequent rapid reporting of matches by the Custodian are key elements in this.

The Custodian has participated in five special initiatives set up between one supplier, the FSS, and police forces during the last year, including Operation BRIL (Burglary Reduction in Leeds) in West Yorkshire and Operation Safer Homes in the West Midlands. Both of these are aimed at reducing burglary. Some 5,376 profiles were submitted, 3,280 matches were obtained and the match reports were issued within 3 hours of the profiles being submitted for loading to The National DNA Database®. The result was a substantial reduction in the time it takes between the report of a crime and an offender being charged by the police. The National DNA Database Board will be considering the potential to extend this rapid service to other police forces

The Custodian has also supported one supplier laboratory by carrying out searches of the Database to identify potential close relatives of an offender where there is no profile from the actual offender on the Database. This enabled the supplier to provide the police with a list of names for persons whom they could then approach to check if they had a relative who could have committed the offence. The case study below demonstrates the value of this novel approach.

The Database Board has recently sought advice from the Information Commissioner on the ethics and data protection issues of using this new approach more widely and will be issuing guidelines in the near future.

Case Study

Teenagers Pauline Floyd, Geraldine Hughes and Sandra Newton were raped and strangled in South Wales in 1973. Despite a huge manhunt, the cases remained unsolved for 29 years.

Sandra, aged 16, was murdered in Briton Ferry and best friends Pauline and Geraldine, also 16, were killed three months later in nearby Llandarcy. In November 2000, the FSS used Low Copy Number (LCN) DNA technology on staining from the clothing of the two friends. A full DNA profile was obtained from residues of semen, but a search of The National DNA Database® and an intelligence-led DNA screen failed to find a match.

Last year, LCN DNA profiling was also used to test items from the first murder. A DNA profile was obtained and this matched that from Pauline and Geraldine's clothing- linking the three murders for the first time. The DNA profile was repeatedly checked against The National DNA Database® but again without any match being found.

A novel approach was then tried - familial searching. This involved searching The National DNA Database® for anyone with a DNA profile that might suggest they were related to the murderer. The search yielded fewer than 100 names and this, combined with information that South Wales Police already had, led to local man Joseph Kappen being identified as the prime suspect. But Kappen was deceased, so a proxy DNA profile was created for him by analysis of samples from other family members who had volunteered to help the investigation. The results of these DNA tests confirmed that Kappen's profile would match that from the two murders and led to his body being exhumed. Subsequent DNA tests on his remains showed a perfect match with samples obtained from the bodies of the three dead girls.

Impact on Crime Reduction

The strategic importance of The National DNA Database® is well recognised - ACPO and the Home Office work closely with the custodian and DNA suppliers to raise awareness and to significantly increase the routine police use of DNA.

The impact of the Database on crime reduction is demonstrated by the figures below. These derive from the DNA Expansion Programme, covering the police forces of England and Wales. In 2002-2003, the police attended 998,000 crime scenes, recovered potential DNA material from 100,000 of these and put profiles on the Database for 57,000. The police also added 405,000 CJ sample profiles to the Database and obtained 21,000 potential detections. The probability of identifying one or more suspects for an offence, when a profile from a crime scene is loaded to the Database, is over 40%.

80% of matches for CJ samples related to offences different from the initial arrest offence for which the CJ sample was taken and a growing number of matches involving serious crimes followed initial sampling for minor offences. Further case studies on pages 27 and 28 provide powerful examples of this. For domestic burglary, the detection rate increased from 14% to 44% when DNA was available. Each crime detected with DNA led to 0.8 other crimes being detected and the Home Office estimate that some 50% of detections led to convictions, 25% of these led to custodial sentences and each custodial sentence prevented a further 7.8 crimes being committed.

The value of the police continuing to take samples from the widest possible range of suspects is thus clear.

Section 8: Financial Report

The costs of the day to day operation and development of The National DNA Database® are recovered through 3 income streams:

- For Custodian Operations Services - the costs are recovered from police forces through a Custodian Service charge, which is a charge per profile loaded. This charge is set for each financial year, based on an annual Custodian budget agreed with the The National DNA Database® Board and an assumption of the number of profiles to be loaded. If this assumption is incorrect it is reconciled in the following year. The budget also allows for a surplus to be made on Custodian Operations Services sales as a contribution to replacement of the Custodian IT infrastructure and further development work.

  However, an analysis of Custodian Operations Services costs carried out during the year showed that the costs of the business support provided by the FSS, particularly for IT services, were not being fully reflected and were being significantly subsidised by the FSS.

  For 2002-2003, the income and costs were:

  Custodian Operations Services indicative sales: £915,399
  Custodian Operations Services indicative costs: £774,304

- For the Custodian PT Services - the income is derived from suppliers via the charges levied on the individual proficiency tests.

  For 2002-2003, the income and costs were:

  Custodian Proficiency Testing indicative sales: £163,505
  Custodian Proficiency Testing indicative costs: £320,507

  The analysis of Custodian costs revealed that the proficiency testing has also been subsidised by the FSS for 2002-2003.

- For Custodian IT Development (hardware and software) - funding of £2.4 million has been provided by the Home Office during 2001/02 and 2002/03, as part of the DNA Expansion Programme. A submission has been made to the Home Office for a 2-year programme of follow-on IT developments.

The costs and charges need to be brought into balance and more secure funding needs to be agreed for Custodian IT development for the future. The National DNA Database Board® is currently considering, with other stakeholders, how this is best achieved.

Further Case Studies

OPERATION PHOENIX – Launched in March 2002 with more than 300 cold case reviews of sexual assaults dating from 1985 to 1999. Led by Northumbria police with REACH and FSS specialist advisors.

The operation involved the re-examination of evidence using the latest techniques to speculatively search The National DNA Database®. Where matches occurred, investigating officers approached the CPS to determine whether or not the investigation should be re-opened.

The first conviction obtained via Operation Phoenix occurred in January 2003. Mark Wilkinson, from Roker, Sunderland, was found guilty and jailed for 5 years for the rape of a 19 year old student 7 years earlier. A routine swab, which had been taken from him in December 2001 when he was arrested for urinating in a South Tyneside street, linked him to the rape. The work of this operation is ongoing.

OPERATION FLAME – Almost £500,000 had been stolen during 18 raids on Post Offices in North Wales, the North West and the Midlands over an 18-month period. Post Office staff were attacked in their homes, taken to their place of work and held hostage while they waited for safe time locks to be released.

DNA evidence was used to link the perpetrators to particular raids. A full SGM Plus™ profile was obtained from a balaclava found in a car used on the first raid at a Post Office in Anglesey. The profile was loaded to The National DNA Database® and a match was made to Alan Motion, whose profile was present on the Database as a result of a minor domestic incident. In addition a profile was gained using LCN DNA profiling from screws used to fix a false number plate on a car used in 3 robberies. This also matched Motion's profile.

LCN DNA profiling was also used to gain a profile from the handle of a safe opened during a raid in Staffordshire. When loaded to The National DNA Database® the profile matched that from John Barlow.

During Operation Flame nearly 700 items were examined. DNA evidence, along with more traditional evidence from footwear marks and fibres, ultimately linked the different scenes, as well as providing police with names via The National DNA Database®.

John Barlow, 39 and Alan Motion, 34, both from Liverpool, were convicted of conspiracy to commit armed robbery and sentenced to 16 years in jail.

OPERATION VAGABOND – John Wood was arrested for stealing £10 of groceries in 2001 and turned out to be responsible for an unsolved sex attack on two young girls in 1998. A profile from a routine DNA sample taken by Kent Constabulary for the sex attack matched a crime stain profile for the sex attack held on The National DNA Database®.

Wood's two young victims, aged 9 and 11, had been subjected to an hour long attack at their Canterbury home. Wood pleaded guilty to rape and indecent assault and was sentenced to 15 years imprisonment.

Glossary of Terms

ACPO
Association of Chief Police Officers

Amelogenin
The name given to the part of DNA analysis which indicates the gender (i.e. sex) of the individual.

CJ sample
See Mouth Swab

Custodian
The person accountable to The National DNA Database® Board for maintaining the integrity of the data held and the efficient and effective provision of the Database information and services specified by the Board. The role of the Custodian of The National DNA Database® is discharged through the role of Chief Scientist of The Forensic Science Service®.

DNA
Stands for Deoxyribonucleic acid. DNA is a molecule found in the cells of all people, animals, plants and other organic matter. The cells, of which the human body has countless millions, are the building blocks of any living organism. In human beings, for all forensic purposes, every cell contains DNA. Variations in the DNA code are responsible for physical differences between individuals including their sex, height, and hair and eye colour. Except for identical siblings (e.g. twins), each person's DNA is unique.

DNA profile
The pattern of DNA characteristics used to distinguish between individuals. A DNA profile may be visualised as a pattern of bands on a computer screen in a graphic representation known as an electopherogram (EPG) or as a numeric code on The National DNA Database®.

DNA profiling
The laboratory technique used to obtain a DNA profile.

DNA sample
A sample taken from an individual, such as a mouth swab, plucked hair roots or venous blood which contains the DNA of the individual for analysis.

Elimination sample
A DNA sample provided with consent by an individual for elimination purposes only.

FSS
The Forensic Science Service®

Genetic information
The sequence or chemical structure of the DNA molecule which carries the genetic 'message'.

HGC
The Human Genetics Commission, an advisory body set up by the UK government at the end of 1999, to consider the public interest issues in relation to developments in genetic science.

Intelligence
Information or knowledge that a police officer can use to progress an investigation. DNA profiles generated from CJ samples and crime scene samples are loaded to The National DNA Database® and are compared with all profiles that it contains. This generates matches between the profiles of the suspects and crime scenes and links crime scenes together, providing primary intelligence for the police.

LCN-DNA
Low copy number DNA analysis. A very sensitive DNA system designed to obtain a DNA profile from very small amounts of DNA. It is mostly used in high profile, serious crime cases where conventional DNA systems have failed to give a profiling result.

Mouth Swab
A sample of DNA collected on a special swab by rubbing the swab on the inside of the cheek to collect cellular material. May also be known as a Criminal Justice (CJ) Sample, Evidential Sample or Elimination Sample.

Police and Criminal Evidence Act 1984 (PACE)
The legislation setting out the regulations by which intimate samples (Section 62) and non-intimate samples (Section 63) can be taken. In addition, Section 64 details the regulations for the retention and destruction of samples and Section 65 defines the terms and appropriate form of consent for taking intimate and non-intimate samples.

Police Elimination Database (PED)
Contains DNA profiles of police officers, crime scene examiners and police ancillary personnel. Since 1 April 2003, police regulations require all new police recruits to the service to provide a sample for the PED. The purpose of the PED is to eliminate DNA profiles left innocently at the scene by the first officers attending or by a crime scene examiner.

(PNC)
Police National Computer

Recordable Offence
A wide range of offences from homicide to minor thefts and criminal damage. Recordable offences are broadly those offences that could lead to a custodial sentence.

Reference sample
A sample taken under PACE from a person for comparison with a specific crime scene sample.

Second Generation Multiplex (SGM)
A DNA profiling system in which seven DNA areas (six informative loci plus a sex test) are analysed to obtain a DNA profile. This was the original DNA system used by The National DNA Database® on its introduction in 1995. The average discriminating power was 1 in 50 million.

SGMPlus™
The DNA profiling system in current use for The National DNA Database® and for forensic casework and paternity analysis. In this system ten informative DNA areas and a sex test are analysed to give the DNA profile. The quoted discriminating power for a full DNA profile is 1 in 1,000 million.

SOC samples
Samples of a range of evidence types (e.g. blood, hair, semen, saliva, etc.) recovered from scenes of crime.

Short Tandem Repeat (STR)
A specific short length of the DNA that is repeated, end-to-end, within the DNA molecule. Different people will have different numbers of repeats and hence different lengths of the repeated DNA. The STR profiling technique examines the lengths of these repeat units and converts the lengths into a digital output.

Supplier
Any organisation, or unit of an organisation, which is authorised by ACPO to load DNA profiles to The National DNA Database®.

The National DNA Database®
An electronic collection of DNA profiles attributed to individuals or scenes of crime. The profiles are generated from persons suspected of, reported for or convicted of a criminal offence and from crime scene stains.