



Annual Report of The Ethics Group: National DNA Database

2015

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Chair's Introduction



I am delighted to present this the eighth annual report of the ethics group and to reflect on what has been another busy period for the group. Since its inaugural meeting in September 2007, the National DNA Database (NDNAD) Ethics Group (EG) has been a valuable source of independent ethical advice to the Government on the operation of the NDNAD database and the collection of DNA samples, their retention and use.

This year the Ethics Group underwent a Triennial Review where the continuing need for ethical advice from the EG and its function and structure were independently challenged. I am delighted to report that the first stage of the review found that the EG continues to provide a necessary function and should remain as an independent advisory body to the Home Office. The Triennial Review proposed that the remit of the group should be extended to include biometrics and forensics.

The Forensic Science Strategy has now been published and the EG welcomes the recommendation that *“the remit of the NDNAD Ethics Group will be expanded to include both forensic science and biometric information”*. We are still awaiting further details about the precise remit of the new group and details of the governance structures to be implemented within the Home Office that will facilitate the EG carrying out this expanded role. However, we are very supportive of these changes and we look forward to considering ethical principles across a broader range of biometric identifiers and forensics in the future.

In this report you will be able to read about the work, activities and advice of the EG throughout the year, including an update on previous EG recommendations (see Chapter 6), but let me pick out some of the highlights for you here. The EG provided ethical advice on a pilot project to exchange DNA profiles with other European countries for the purpose of assisting with the investigations of cross-border crimes. The success of the pilot has contributed to a decision by the UK Government to rejoin Prüm – which will allow for the rapid international exchange of DNA, fingerprints and vehicle registration numbers. The EG wrote to the Home Secretary in support of this decision emphasising that solving serious crimes, whether they occur in the UK or abroad, should be of equal moral concern.

The EG took a keen interest in developments in the area of next generation sequencing (NGS) and the group heard about the technology, its applications and limitations through a number of events held throughout the year. Whilst we are supportive of the development of these technologies and for their application in the investigation of crimes, we have made a recommendation in this area that they should be considered in a stepwise fashion and that a regulatory framework should be developed in tandem to oversee the ethical issues (see Chapter 4).

Further work for the group this year has been to provide ethical advice in relation to the retention and use of custody images. We learnt that there are discrepancies amongst police forces as to how long they retain custody images and we highlighted the need for improved public

engagement to make the public better informed of the specific uses of custody images. We also saw that a distinction could be made between taking custody images for which the purpose is clear, and the retention and use of those images for other purposes than originally intended and for which consent has not been given. We made a recommendation in this area that robust governance structures should be in place for all government databases that contain biometric identifiers (see Chapter 4).

At this period of substantial change for the EG, the group and I eagerly look forward to the year ahead, to the consolidation of the role and remit of the new-look Ethics Group and to the debates and challenges that lie before us.

I hope you find this annual report useful and informative.

Christopher Hughes OBE

Chair, Ethics Group: National DNA Database

Chapter 1: Vision, Mission and Values of the Ethics Group

Background

The Ethics Group (EG) of the National DNA Database (NDNAD) is an advisory non-departmental public body of the Home Office. It was established in 2007 to provide Ministers with independent ethical advice on the operation and practice of the NDNAD. Its membership includes representatives from various disciplines and professions and it is led by an independent Chair. It publishes its minutes, an annual report, various discussion papers and advice to Home Office Ministers on the government website.

Vision

To ensure that all decisions relating to the forensic use of DNA (obtaining, storage, retrieval) are considered in the light of ethical and human rights principles, and that individuals may only have their DNA taken for lawful forensic purposes and at all times be treated fairly and with dignity and respect.

Mission

The EG aims to ensure that the culture of the operational framework supporting the NDNAD in England and Wales places ethical issues at the forefront of all activities at all times.

Values

The following values and principles underpin the EG's role in terms of establishing and resolving ethical issues.

- That the NDNAD must have a proper lawful basis that is compatible with the Human Rights Act 1998 and which provides for independent and accountable governance of its operations.
- That there are clear, detailed, open and transparent rules governing the everyday operations of the NDNAD so as to ensure that processes are just and lawful and provide sufficient guarantees against the risk of abuse.
- That the use of forensic DNA sampling should be appropriate and proportionate and should not discriminate against members of any section of society.
- That the operations of the NDNAD are at all times fully based in credible science that shows a strong and cogent rationale for justifying such activities.

- That all decisions taken in relation to the operation of the NDNAD within the criminal justice system are proportionate and fair when balancing the rights of individuals against the needs of society to detect and prevent crime.
- That all persons who are lawfully required to give a DNA sample are treated fairly with dignity and respect and that there is an established independent appeals process to guarantee their right to an effective remedy.
- That the public is fully informed about all aspects of the NDNAD in ways that are understandable including providing information to those individuals who are required to provide a DNA sample.
- That research using the NDNAD is only permitted after full consideration that it is fully compatible with these principles and has been submitted to independent scientific and ethical scrutiny.
- That the rights of children, young people and other vulnerable people should be protected in light of their vulnerability and in accordance with international conventions.

Chapter 2: Membership of the Ethics Group

The current Ethics Group (EG) membership is as follows:

Chair: Christopher Hughes OBE

Members: Dr Adil Akram
Dr Daniele Bryden
Dr Alan Clamp
Dr Nina Hallowell
Dr Christopher Harling CBE
Professor David Latchman CBE
Carol Moore CB
Isabel Nisbet
Professor Barbara Prainsack
Professor Jennifer Temkin

Further information about members can be found in Appendix A: Biographies of Ethics Group members.

The following individuals/organisations are represented on the EG:

The National DNA Database Delivery Unit
The Forensic Science Regulator
The Biometrics Commissioner

Chapter 3: Activities of the Ethics Group

Meetings

This year there were four general meetings of the Ethics Group (EG). The minutes of these meetings are published and can be found on the gov.uk website via the web link:

<https://www.gov.uk/government/organisations/national-dna-database-ethics-group>

At its meetings the EG heard contributions in the form of presentations from:

- Jo Ashworth, East Midlands Special Operations Unit Forensic Services, on rapid DNA;
- Robert Butlin, Home Office, on Prüm business and implementation case;
- Vasant Chari and Nilam Jadhav, Home Office, on custody images review;
- Madeleine Greenhalgh, Cabinet Office, on an ethical review framework;
- Shazia Khan, Metropolitan Police Service, on Y-short tandem repeat (Y-STR) pilot proposals;
- Adam Shariff, National DNA Database (NDNAD) Delivery Unit, on developments in DNA processing;
- Riz Shariff, NDNAD Delivery Unit, on a Central Elimination Database;
- Dr Denise Syndercombe-Court, King's College London, on next generation sequencing; and
- Stephen Webb and Amanda Cooper, Home Office, on the biometrics and forensic strategies respectively.

Home Office Business

The EG has been informed of a number of Home Office business work-streams and strategies throughout the year.

National DNA Database Strategy Board

The EG continued to work closely with the NDNAD Strategy Board (SB); the NDNAD SB is responsible for implementing the recommendations of the EG. The EG Chair sits on the SB as an *ex-officio* member and EG members with lead responsibilities for certain issues have been involved in SB work programmes where appropriate.

Biometrics Programme and Strategy

The Biometrics Programme and Strategy includes a number of programmes to improve data handling and synergy within the Home Office. The Biometrics Programme will provide a single platform across the Home Office and wider government for biometrics, focusing on fingerprints,

DNA and facial recognition services. Mechanisms will be required to ensure that the ethical and legal issues are considered in relation to the storage of the data and the strategy will set out clear regulatory regimens to ensure the legal and ethical legitimacy of data sharing and linkage.

Forensic Science Strategy

A number of work-streams were included in the development of the Forensic Science Strategy including legitimacy, knowledge and skills, digital forensics, supply chain and forensic futures. Of particular interest to the EG has been the legitimacy work-stream, which covered ethics, governance, regulation and oversight; EG members recognised this work as underpinning the entire model. Review of this work-stream would ensure that the model remains fit for purpose. The Forensic Science Strategy has now been published and is available at the web link: <https://www.gov.uk/government/publications/forensic-science-strategy>. The EG welcomed the enhanced governance for the forensic system, which included a wider role for the EG.

Custody images review

The custody images review consisted of a review of eight police forces regarding their processes for handling and storing images that are taken of individuals when they are detained in custody. The review also examined the processes in place in other European countries. The EG supports the development of a clear and proportionate framework for the management of custody images.

Ethics Group Representation at Other Meetings

Throughout the year the Chair and members of the group have met with, attended and/or made contributions or representations to the following.

- Alan Clamp sat on a project to evaluate rapid DNA trials across police forces. Further information is provided in Chapter 4.
- Christopher Harling sat on an expert network to identify 'risks to the supply chain'. Further information is provided in Chapter 4.
- The Chair addressed an Economic and Social Research Council (ESRC) Seminar on forensic genetics and criminal justice at Northumbria University.
- The Chair contributed to the Forensic Science Review and a workshop on Prüm.
- The Chair met with Alex Marshall at the College of Policing to discuss responsibility for oversight and promotion of research around the DNA database.
- The Chair represented the EG on the NDNAD SB. Further information is provided in Chapter 4.
- The Chair spoke at the Chartered Society of Forensic Services event on next generation sequencing.

Other members of the EG kept 'watching briefs' on their various topics of responsibility and took part in relevant visits and briefings, which are too numerous to mention here.

Events

Royal Society event –paradigm shift in UK forensic science

Five members of the EG attended the Royal Society event on an imminent paradigm shift in forensic science. This focused on how to capitalise on the anticipated changes in order to develop, design and promote a robust, effective and efficient capability that would best serve the criminal justice system. A number of issues were raised at the meeting that were of relevance to the wider remit of the EG.

These issues were:

- the challenges that would emerge from the linking of different datasets and linking technologies;
- as errors are an inevitable feature of algorithm-based biometrics identification technologies, whether systems should err on the side of false positives or negatives;
- the use of statistics in evaluating evidence and the explanation of these to lay people, and a requirement for transparency in how conclusions have been reached;
- an over-reliance on DNA evidence brings the risk of the potential loss of a variety of trace evidence analysis providers including glass, fibres, chemicals and dyes; and
- technology moving analysis closer to the scene of crime but bringing with it the risk of bias and the need for evaluation of trace evidence ring-fenced away from information that could distort the judgement of the analyst.

The EG believes that far greater in-depth discussions of a wide range of ethical principles are required in this area including privacy, justice, fairness, right to practise religion, right to family life, oversight of systems and protection for individuals if things go wrong.

Knowledge Transfer Network workshop on ‘phenotyping – making the technology operational’

Phenotyping is the use of DNA analysis in order to obtain information about externally visible traits and/or the likely ethnic background of a person. The workshop was attended by a number of members of the EG and discussed the barriers to implementing phenotyping technology and the opportunities it might afford in the future. There were discussions about the accuracy of the technology for determining physical features including eye colour, hair colour, height and ancestry. Also how the police might use phenotyping technologies in the future, for example, privately for intelligence purposes, and the ethical issues including the need for public debate, robust science and demonstrable benefit.

Other Activities

Members of the EG visited their local police forces, which included Devon and Cornwall Police, the Metropolitan Police Service, Northamptonshire Police, the Police Service of Northern Ireland and Police Scotland. The visits served to improve communication with police forces and to improve members’ awareness of operational matters and needs. The EG will continue to explore how to engage strategically with the police on core ethical issues.

Chapter 4: Work of the Ethics Group During 2015

Ethical Advice for Government

National DNA Database Strategy Board

The Ethics Group (EG) was invited by the National DNA Database (NDNAD) Strategy Board (SB) to consider whether proposed changes to the NDNAD SB's policy for access and use of DNA samples, profiles and associated data were appropriate from an ethical perspective. The policy detailed the access and use of the samples, profiles and associated data for those samples taken for the purposes of being loaded to the NDNAD.

The changes to the policy were largely in relation to the retention of samples for the purposes of elimination. The policy was being updated to allow for the retention of DNA samples from the relatives of missing people to allow DNA tests to be undertaken in the future to assist with the identification of bodies. Consent forms associated with the policy, which form part of the suite of subject sampling forms, were also updated and the ethics members reviewed the content in these forms.

The EG provided further advice to the NDNAD SB in relation to a request from the Department for Work and Pensions to the NDNAD SB, to be able to compare DNA profiles taken under the Police and Criminal Evidence Act 1984 with profiles obtained from DNA samples provided for determining paternity. These comparisons were requested for child maintenance cases where there was a suspicion of fraud. The EG advised that the investigation of a crime was reasonable justification for the samples to be used.

The EG also reviewed the DNA laboratories anti-contamination guidance. The group raised with the NDNAD SB the necessity for transparent reporting of contamination incidences in order to understand the risks that might arise in the end-to-end DNA profiling process.

Biometrics Commissioner

The role of the Commissioner for the Retention and Use of Biometric Material ('the Biometrics Commissioner') was established by the Protection of Freedoms Act 2012. The Act also established a new regime to govern the retention and use by the police in England and Wales of DNA samples, DNA profiles and fingerprints. One of the key responsibilities of the Biometrics Commissioner is to provide independent oversight of the new regime. The Biometrics Commissioner ensures that DNA profiles are retained on the NDNAD in accordance with statutory provisions and this role therefore has some overlap with the EG's advisory role on ethical issues around the operations of the NDNAD. The EG and Biometric Commissioner work collaboratively on overlapping issues and the Biometric Commissioner or a representative from the Biometrics Commissioner's office attended all EG meetings in 2015.

Throughout the year the EG has been kept informed of the numbers of applications to the Biometrics Commissioners by the police forces for DNA profiles and fingerprints to be retained on the NDNAD (under section 63G of the Police and Criminal Evidence Act 1984) and other strands of the Commissioner's work.

Forensic Science Regulator

The Forensic Science Regulator (FSR) ensures that the provision of forensic science services across the criminal justice system is subject to an appropriate regime of scientific quality standards. The FSR issued a consultation on two draft guidance notes that resulted in a response from the EG. These were:

- the control and avoidance of contamination in crime scene examination involving DNA evidence recovery; and
- the control and avoidance of contamination in laboratory activities involving DNA evidence recovery and analysis.

The guidance notes, which were largely technical, represented best practice for the avoidance of contamination of samples with adventitious DNA, which would complicate the subsequent analysis. The EG highlighted its concerns surrounding the use of natural rubber latex gloves in the guidance notes, which can promote dermatitis in wearers. Dermatitis, even in mild forms, is known to increase shedding of skin thereby increasing the risk of contamination. The EG also cautioned about the cleaning of gloves and recommended that disposable gloves of the type used at crime scenes and in the laboratory should always be changed and not cleaned.

International Exchange of DNA – Prüm

The Prüm Convention enables European Member state signatories (currently [as at 2015] Austria, Belgium, France, Germany, Luxemburg, the Netherlands and Spain) to exchange data on DNA, fingerprints and vehicle registration numbers of persons suspected to be co-operating in terrorism, cross-border-crime and illegal migration rapidly, on a 'hit'/'no hit' basis. The UK had previously opted out of Prüm. In last year's annual report, the EG welcomed the development of proposals for a pilot project that would allow the Metropolitan Police Service to undertake a trial involving rapid sharing of DNA profiles with other European countries.

The Prüm pilot by the Metropolitan Police Service for the international exchange of DNA profiles went ahead this year, using data from crime scenes across England, Wales, Scotland and Northern Ireland. Rapid links were established between the NDNAD in the UK and databases in France and Germany, the Netherlands and Spain. The pilot produced a total of 118 matches with profiles from either persons or crime stains in other countries. Whilst the outputs from this pilot in relation to the number of arrests and convictions have still to be analysed, it can be concluded from the pilot that the Prüm arrangements provided for more efficient matching of DNA profiles than currently exists with Interpol mechanisms, allowing international databases to be searched within 15 minutes rather than the average time of 147 days for Interpol enquiries.

The EG considered the ethical challenges that would arise from the international exchange of DNA profiles and was largely satisfied with the measures that would be put in place. These included safeguards and precautions against the extradition of innocent people with the

rules of Prüm mitigating against this risk as far as possible, although there would always be a small possibility for errors to occur. Furthermore, only countries with International Standards Organisation (ISO) 17025 accreditation of their DNA analysis procedures were able to join Prüm, with errors such as sample switching being checked through audit trails. It was confirmed that rigorous procedures and checks would be put in place to safeguard against unnecessary extradition from the UK; if a suspect were to be extradited from the UK their fingerprints and DNA would be taken again for use in the UK courts rather than reliance on the original match identified via Prüm.

The EG welcomed the Government's recommendation for the UK to rejoin Prüm. The group noted that from the perspective of ethics and justice there was a responsibility to act; the rapid international sharing of DNA profiles was likely to increase the capabilities of police forces in the UK and abroad to identify the perpetrators of crimes, bring justice to their victims and prevent further serious crimes. The EG letter to the Home Secretary in support of this recommendation is available at the web link:

<https://www.gov.uk/government/publications/joining-the-prum-agreement-letter-to-the-home-secretary>

Going forward as the UK rejoins Prüm, the EG will continue to provide ethical advice in this area.

Custody Image Review

During 2015 the Home Office undertook a review of custody images and requested advice from the EG on the ethical considerations in relation to the retention of these images. The request fell outside of the remit of the EG as it stood at the time. However, given the proposed expansion of the remit of the EG in the future and the experience of EG members, the EG agreed to respond.

There are clear differences between the ethical considerations that arise in relation to the use of DNA for assisting criminal investigations and the use of facial recognition technology. For example, DNA originates from a single data set (the sample) while facial images originate from multiple sources including CCTV, passports and social media, as well as custody images. Furthermore, DNA technology is able to produce exact matches whilst the matches obtained with facial recognition technology are likely to be probabilistic. However, when considering the retention and use of material, similar ethical principles can be applied across all biometric identifiers (including custody images) with nuances specific to the type of material.

Custody images are the pictures of individuals taken by police forces when a suspect is arrested. Police forces have indicated that custody images are an important investigative tool. However, there is no guidance for police forces on how long they should retain these images. Some police forces have taken the decision to handle custody images in line with the retention times indicated in the Protection of Freedoms Act 2012 for the retention of DNA profiles and fingerprints¹ while other police forces retain custody images indefinitely or until the subject requests for them to be deleted.

¹ Retention periods for DNA profiles and fingerprints as directed by the Protection of Freedoms Act 2012 vary depending on the age of the individual, the type of offence (a minor offence, a qualifying offence or a recordable offence), whether it is a first or subsequent conviction and whether an application has been made by a chief constable to a district judge for an extension to the retention period. An overview is available in the NDNAD SB Annual Report 2014–15, available at: <https://www.gov.uk/government/publications/national-dna-database-annual-report-2014-to-2015>

A preliminary media scan undertaken by the Home Office indicated that there was little public concern regarding the retention of custody images. However, the EG cautioned that this lack of public concern may be as a result of the public having little knowledge about the specific uses of custody images and that an informed public would be likely to have different opinions. Therefore, public engagement activities, through which the public become better informed of both the implicit and explicit possibilities for the use of custody images is required prior to seeking feedback about concerns.

Whilst the taking of photographs may not initially be considered to be intrusive, the storing and searching of images are likely to raise significant concerns with regard to privacy. In recognition of this, the EG believes that a clear distinction needs to be made between the taking of custody images, for a specified purpose, and the retention and use of that image for other purposes than originally intended and for which consent has not been given. The EG is aware of the propensity for errors in the use of digital searches of custody images, and the potential for these searches to result in mistaken identity and the wrongful inclusion of an individual in the early stages of a police investigation.

The EG has made the following recommendations in this area.

The retention times directed in the Protection of Freedoms Act 2012 for the retention of DNA samples and fingerprints should also be applied to the retention of custody images.

Robust governance structures should be in place for all police databases that contain biometric identifiers, including custody images. Careful consideration should be given to the most appropriate mechanisms to facilitate take-up and compliance with a biometrics ethics framework.

Cabinet Office Ethical Review Framework

The data science team within the Cabinet Office sought advice from the EG on an 'Ethical Framework for Use of Data', which is being developed to provide reassurance that data are used within the Government in an open and transparent way. The aim of the ethical framework would be to provide officials with a reference point for relevant ethical questions to be considered during all government data projects. The framework will include principles to be followed by the Government when using data, such as the public benefit outweighing any perceived levels of harm.

The EG welcomed the framework and believes that it will be a valuable tool to stimulate thinking. However, ethical considerations are continuous and dynamic and therefore ethical considerations should be kept under review throughout the lifetime of a project. This requirement ought to be built into the framework.

The EG recommended that the Cabinet Office incorporates continuous ethical consideration into the 'Ethical Framework for Use of Data'.

Ethical Advice on New DNA Sequencing Technologies

Next Generation Sequencing

Next generation sequencing (NGS) is a term used to describe DNA sequencing technologies, whereby multiple pieces of DNA are sequenced in parallel, thereby allowing large sections of

the human genome to be sequenced rapidly. The term is a catch-all phrase that refers to high-throughput sequencing rather than the far slower Sanger sequencing technology.

The short tandem repeat (STR) analysis, which has been used by forensic laboratories for over 20 years, has already revolutionised the use of DNA in forensic identification of crime scene samples. However, declining costs associated with sequencing has resulted in the development of a number of NGS technologies that could have the potential to assist even further with criminal investigations. For example, single nucleotide polymorphism (SNP) analysis looks at single base pair genetic variations between individuals and can provide detailed information about ancestry, genetics relatedness and individual identification. SNPs can also provide phenotypic predictions such as eye, hair and skin colour, male pattern baldness and facial features.

Throughout the year the EG took a keen interest in developments in NGS and invited a number of experts to meetings in order for the group to be appraised of developments in this area. The EG is aware that some of these NGS technologies in development are likely to be able to assist with the investigations of crimes and the apprehension of offenders. Therefore, there is a clear ethical argument for the implementation of the technologies into criminal investigations. For example, focused sequencing of STRs would lead to improved statistics for match probabilities, greater precisions for mixture analysis and more accurate predictions of genetic relationships. However, there are other NGS technologies where the benefits have yet to be defined and the potential level of intrusion on individuals could be considerable. As with all developments in DNA profiling, there is a need to consider what level of intrusion is permissible under what circumstances, and what controls are required.

The EG expresses caution in regards to NGS techniques being used as tools for intelligence purposes, for example, to narrow the field of suspects, and cautions against the use of these techniques with fewer safeguards in place. There are strict regulations in place for the use of STR profiles to assist in criminal investigations and similar regulations are needed for the new NGS techniques. Furthermore, some NGS techniques are not 100 per cent predictive or accurate. It is important for stakeholders and the public to be aware of the current limitations of these tests to ensure that results are not misconstrued and conclusions are not made on the basis of a poor understanding of the results. The EG believes that need and utility should be the drivers for the implementation of NGS technologies in criminal investigations rather than availability and affordability.

The EG made the following recommendation.

New NGS techniques must be considered in a stepwise fashion, both practically and ethically. A regulatory framework should be developed, in tandem with technology development, to oversee the ethical issues and the collection, compilation, storage, sharing and use of information and data derived from NGS technologies.

Going forward the EG will focus its attention on those areas of NGS that are likely to be used imminently or that might be fast-tracked due to their potential utility. These include the potential use of Y-STRs for identification purposes (both predictions for physical traits and genetic relatedness).

Y-STR Profiling

Y-STR profiling is a technique that is increasingly being used as a tool in forensic investigations. The Y-chromosome is found only in males and is inherited from the male parent, and so analysis of markers on the Y chromosome can be used to link males who have the same paternal ancestry. Y-STR profiling is valuable in the investigation of sexual assault cases, where the large volume of female DNA might mask any trace levels of male DNA that is present if analysed using standard autosomal STR profiling techniques.

The EG undertook an ethical evaluation of a proposal put forward by the Metropolitan Police Service (MPS) for a six-month pilot to produce Y-STR profiles from crime scene stains in sexual assault cases.² The objective of the pilot was to attempt to establish links between cases involving sexual crimes. The EG requested clarity on how the pilot would be evaluated. It expressed caution that without a thorough evaluation and testing of the conclusions, there was a risk that the pilot would in reality become a phased roll-out of Y-STR profiling with little genuine testing of its forensic utility. The MPS provided the criteria against which the pilot would be evaluated.

In considering whether the Y-STR pilot would be ethical, the EG was aware that a test focused solely at one gender may be inequitable. Whilst arguments about discrimination against males could be raised the EG thought that there were stronger arguments in favour of using the tests that would assist in the investigation of serious crimes, such as sexual assaults and murders. The group concluded on balance that it would be more inequitable not to make use of Y-STRs when the means to do so were available.

The EG believed that the proposal was ethically sound and gave its support for the trial to go ahead. The EG were mindful that further ethical considerations would be required if Y-STR profiling were to be rolled out nationwide and if Y-STR profiles were to be stored on the NDNAD. The reason being that Y-STR profiles have the possibility to reveal sensitive information about parentage and adding Y-STRs to the NDNAD would open up the possibility of identifying male individuals through genetic links, which was not previously possible. The EG has agreed to review the outcome of the pilot at the evaluation stage

Last year (2014) the EG made two recommendations in relation to the introduction of Y-STR profiling.

- Following the introduction of Y-STR allele profiling, the use of these profiles should be monitored and an ethical impact analysis should be carried out.
- Informed public consultation and debate about ethical issues arising from the profiling and storage of Y-STR alleles should be prioritised and facilitated.

The EG will continue to monitor progress of these recommendations and press the NDNAD SB for their implementation.

Rapid DNA Profiling

Rapid DNA analysis has the potential to produce a DNA profile within 70 minutes contrasting with many hours and even days taken by current DNA profiling systems. The equipment used to carry out these analyses is often portable and cheaper than conventional DNA profiling

² The Y-STR profiles obtained during the pilot would be stored on a database held by the MPS, which is not linked to the NDNAD.

equipment. In last year's annual report, the EG outlined what it considered to be the overarching ethical issues associated with rapid DNA technology.

This year the EG voiced concerns that the evaluation and implementation of rapid DNA platforms within police forces was taking place in a piecemeal fashion without appropriate ethical scrutiny. The group was therefore supportive of the approach to establish a central project board to evaluate rapid DNA trials across police forces that provided overall governance for this work. Police forces agreed to present their rapid DNA plans to the project board to gain advice on design, ethics and legality. The EG was represented on this project board.

The EG provided advice to the NDNAD SB about a specific rapid DNA platform that had been developed by an external forensic provider working alongside West Midlands Police, and on plans for trials of similar systems within other police forces. The West Midlands trial analysed crime scene and suspect samples from live cases using rapid DNA techniques alongside conventional techniques. The profiles obtained from the rapid DNA technology were checked against the corresponding profiles from conventional technologies and only released to an investigating officer if they matched. Following a review of the project the EG put forward a number of recommendations that are applicable to the review of any rapid DNA projects.

- The results from rapid DNA systems, where those systems include fewer markers than the national system and therefore produce matches with lower match probabilities, should be passed on to investigators with suitable guidance limiting their use; they should not be used solely as a tool for pursuing an arrest.
- An acceptable level of errors for rapid DNA systems must be determined to ensure that police time and resources are not wasted investigating the wrong suspects.
- There must be a sufficient number of appropriate samples included in any pilot study in order to assess statistically the effectiveness of the study.
- Rapid DNA studies must be well designed with governance and external scrutiny from the outset, including ethical scrutiny.
- Detailed work should be undertaken to understand better the risks associated with rapid DNA schemes, including where errors could occur and the mitigation procedures that are in place.

Ensuring all Police and Supplier DNA Databases are Subject to Robust Governance Standards

Assessment of Risks with the DNA Supply Chain

From an ethical perspective the assurance that errors have not occurred throughout the DNA profiling process is very important. Where DNA is used for the purposes of detecting criminals and to exonerate those individuals who are innocent, then a system with fewer errors could be considered a more ethical system. The EG believes that errors that result in the failure to identify a perpetrator of a crime may be just as harmful from a societal point of view as errors that result in a miscarriage of justice, because they can lead to a criminal being free to commit further offences. The group is also aware that new technologies, with improved sensitivities, may

lead to an increased risk of contamination that could potentially lead to the wrongful inclusion of individuals in an investigation.

In last year's report, the EG highlighted that there were many possibilities for errors to occur in the forensic use of DNA and a full understanding of the amount, scale and where the errors occurred was required. The EG recommended that a systematic review of error rates in the collection and forensic use of DNA in the criminal justice system should be carried out. This year a review of errors was undertaken; the EG has continued to provide advice in this area and contributed to the review.

The EG participated in a meeting organised by the Home Office, which included representation from the Biometric Commissioner's Office and the NDNAD Delivery Unit (NDU), in order to determine how the EG's recommendation could be taken forward. An outcome of the meeting was to establish an expert network with the purpose of identifying risks to the DNA supply chain; a member of the EG was one of the experts in the network. The expert network examined the risks of contamination to a DNA sample in the entire chain, from when a DNA sample was recovered from a crime scene, its transportation, analysis by forensic providers or police forces, its interpretation, searches undertaken on the NDNAD and the reporting of the results to the criminal justice system. The network assigned assurance factors to the various steps by inviting experts to assign a rating as to how assured they were that the risk of an error had been mitigated. The EG was informed that the sampling stage, where the initial interaction with the material or subject occurs, posed the highest risk of contamination. The next highest was the evidence recovery stage (this is the stage where screening activities occur in order to recover trace evidence from exhibits). Going forward recommendations will be made by the expert network to help to reduce errors, including recommendations to improve guidance manuals and advice offered to those who attend crime scenes. The EG will continue to keep a watching brief on the outputs in this area.

Ethical Advice on a Central Elimination Database

In order to be assured that crime scene samples have not inadvertently been contaminated by an operative involved in the DNA process it is necessary for DNA profiles to be obtained from those individuals who, as part of their work, come into contact with crime scenes and samples recovered from crime scenes. These elimination samples must be compared against the profiles loaded to the NDNAD and the individuals eliminated. The numerous possibilities for contamination to occur in the DNA profiling process have been outlined in the previous section 'Assessment of risks with the DNA supply chain'.

The Police Elimination Database (PED) has been in operation since 2000 and holds the DNA profiles taken from police officers and staff. Where it is suspected that a crime scene sample may have been contaminated with DNA from a member of the police force, a request can be made for a direct comparison between the crime scene sample and the police elimination profile. However, routine checking between the PED and the NDNAD does not occur and as a result it is likely that many instances of contamination are missed. The EG believes that this raises ethical concerns as contamination could be resulting in lost opportunities to identify potential suspects in criminal investigations. In its sixth annual report the EG recommended that "*Efforts should be made to purge the NDNAD of contamination profiles*".

Significant progress has been made towards achieving this aim and a project is currently ongoing to establish a Central Elimination Database (CED). Once operational the CED is expected to hold the DNA profiles from serving police officers and special constables and will allow profiles from police officers to be checked against samples on the NDNAD. Profiles will not be loaded to the NDNAD nor will any personal information be held on the NDNAD. In April 2015, to allow for the CED to go ahead, police regulations were updated to allow DNA profiles from police officers and other police staff to be checked against the NDNAD. Pilot studies involving a number of police forces have been undertaken whereby the DNA profiles of police officers have been searched against the 500,000 unidentified crime scene profiles on the NDNAD. The number of matches between police officers/staff and crime scene stains is in the process of being confirmed and investigated and the EG suggested that investigations should identify where in the process the contamination could have occurred. The results would feed into additional guidelines for police forces to aid the reduction of contamination risks.

Going forward all forces would complete the pilot check and once the CED is rolled out it would become routine business to check new police elimination profiles weekly against the NDNAD. In the future the CED will be expanded to include the profiles of other individuals who have the potential to contaminate a crime scene or a crime scene sample. The EG will continue to monitor progress in this area.

Chapter 5: Recommendations

1. The retention times directed in the Protection of Freedoms Act 2012 for the retention of DNA samples and fingerprints should also be applied to the retention of custody images.
2. Robust governance structures should be in place for all police databases that contain biometric identifiers, including custody images. Careful consideration should be given to the most appropriate mechanisms to facilitate take-up and compliance with a biometrics ethics framework.
3. The Ethics Group recommended that the Cabinet Office incorporates continuous ethical consideration into the 'Ethical Framework for Use of Data'.
4. New next generation sequencing (NGS) techniques must be considered in a stepwise fashion, both practically and ethically. A regulatory framework should be developed, in tandem with technology development, to oversee the ethical issues and the collection, compilation, storage, sharing and use of information and data derived from NGS technologies.

Chapter 6: Review of the Implementation of Recommendations Made in Previous Annual Reports

Recommendations from previous annual reports that are still being progressed

Report	Recommendation	Progress made	Anticipated date for completion
2014	The benefits of an independent audit and scrutiny of the Counter-Terrorism DNA Database (CTDNAD) should be explored by the Home Office and the Metropolitan Police Service (MPS).	Counter terrorism falls within the remit of the Biometrics Commissioner. The out-going Biometrics Commissioner had published in his 2015 annual report the lack of implementation of the Protection of Freedoms Act 2012 in respect to counter terrorism. The Ethics Group (EG) will discuss this issue with the new Biometrics Commissioner. (See also the recommendation from the 2011 annual report)	2016
2014	In order to promote a better understanding of the sources of error around the forensic use of DNA and to support systematic work around error reduction, a systematic review of error rates in the collection and forensic use of DNA in the criminal justice system should be carried out.	An expert network has been established to <i>'identify risks to the DNA supply chain'</i> . The network has examined the risk of contamination to a DNA sample from when it is recovered at a crime scene, its transportation, analysis by forensic providers or police forces, its interpretation, searches undertaken on the National DNA Database (NDNAD) and the reporting of the results to the criminal justice system. The outputs of this will	2016

Report	Recommendation	Progress made	Anticipated date for completion
		feed into guidance for those who handle crime scene samples. The EG has been involved in this work and is pleased with the progress being made.	
2014	Following the introduction of Y-short tandem repeat (Y-STR) allele profiling, the use of these profiles should be monitored and an ethical impact analysis should be carried out.	Y-STR profiling is used on an ad hoc basis by police forces but there is no centrally held Y-STR database. The EG will monitor the progress of Y-STR profiling with the MPS and will review a report on the outcomes of the initial work.	Not specified
2014	Informed public consultation and debate about ethical issues arising from the profiling and storage of Y-STR alleles should be prioritised and facilitated.	Once the MPS has reported on their Y-STR trial the EG will consider what public debate could be promoted.	Not specified
2013	Efforts should be made to purge the NDNAD of contaminant profiles.	Significant progress has been made towards the establishment of a Central Elimination Database that will hold the DNA profiles from serving police officers and special constables and will allow these profiles to be checked against the NDNAD on a weekly basis. Pilot studies are still ongoing but the EG is pleased with the progress of this work.	2016
2013	The Home Office should collate evidence on rape cases where a DNA match led to a conviction.	The EG is aware of research that is in its preliminary stages, which will link data from the National Crime Agency's Serious Crime Analysis Section to the NDNAD to examine the role of forensics in criminal justice outcomes for stranger sexual assaults. The EG will monitor the progress of this work.	Not specified

Report	Recommendation	Progress made	Anticipated date for completion
2011	All databases containing DNA information including the counter-terrorism database held by the police service should be subject to a robust statutory governance framework, appropriate systems and controls, and should be transparent and only used for statutory purposes.	This recommendation has been subsumed under the recommendation from the 2014 annual report.	2016
2009	As a matter of urgency, to improve the level of easily available and assimilated public information on the use of forensic DNA.	The EG believes that the level of easily available public information on the use of DNA has improved and the Strategy Board annual reports particularly contain a high level of detail. The EG will encourage the SB and the Home Office to ensure that information is readily available to the public.	2016
2008	Improvement of the process for taking consent and providing a better consent form for adult volunteers.	An expert network reviewed the information provided in the consent forms and a representative from the EG fed into this review. The NDNAD Delivery Unit is also developing an information leaflet to be given to people when their DNA sample is being taken. The EG has reviewed this leaflet.	2016

Chapter 7: Future Work Plan

This future work plan for the Ethics Group (EG) has been written paying consideration to the expanded remit of the group to include the ethical issues of all biometric identifiers. Once the remit of the EG has been finalised this future work plan may need to be updated.

- To ensure all police and supplier databases containing biometric information are subject to robust governance requirements and to provide ethical advice on their operations.
- To provide support and advice on ethical matters to the Biometrics Commissioner and others as required, including police forces.
- To embed new governance arrangements and responsibilities for the EG in light of the findings of the Triennial Review of the Group.
- To develop a set of principles and ethical values to be considered by the EG when undertaking ethical reviews for the use and retention of biometric identifiers.
- To continue to monitor and assess potential disproportionate or discriminatory effects that the use and operation of biometric databases may have on ethnic minority groups and vulnerable people.
- To review the Equality Impact Assessment of the Protection of Freedoms Act 2012 after three years of operation.
- To review the policies and safeguards that are developed if the UK joins Prüm and to ensure that the international exchange of biometric information is ethical.
- To continue to monitor the treatment of children and young people in relation to DNA and fingerprint sampling and retention to ensure that they are safeguarded and their distinct rights are recognised.
- To monitor the development of next generation sequencing (NGS) technologies and their applications for the investigation of crimes.
- To monitor developments and consider the ethical issues surrounding rapid DNA testing at crimes scenes.
- To monitor the retention and use of custody images and the implementation of governance structures.
- To monitor the implementation of elimination databases.
- To monitor the review of errors in the DNA supply chain.
- To review the annual report of the National DNA Database (NDNAD) Strategy Board and other policy and consultation documents prepared by the Home Office.
- To review policy on NDNAD access and usage and review opportunities for research using the NDNAD.

Chapter 8: Resources

Costs

The Ethics Group (EG) is funded by the Home Office. Budget spend for the accounting years 2014/15 and 2015/16 were £4,628 and £3,584 respectively.

Costs were associated with the provisions of facilities for meetings and expenses properly incurred by group members in undertaking their duties.

Members are unremunerated for their activities on behalf of the EG.

Secretariat

The EG Secretariat support has been provided by the Home Office Science Secretariat, with costs for the Secretariat met from the Home Office Science Secretariat budget.

Appendix A: Biographies of Ethics Group members

Christopher Hughes, OBE (Chair)

Chris is a UK qualified lawyer and biologist.

He devotes his professional time to a range of part-time public and judicial appointments.

In his judicial capacity he sits in the Health Education and Social Care Chamber dealing with rights of individuals detained in psychiatric hospitals, and in the General Regulatory Chamber resolving disputes about access to information held by public bodies (Freedom of Information), as well as other cases.

Among his public appointments he has served as chair of a statutory regulator and as chair of a forum advising Ministers on chemical regulation. He is an Alternate Chair of the Board of Appeal of the European Chemicals Agency. He has been a member of health and local authorities and served on a regulatory board of the Law Society. He was for many years the Chief Legal Adviser to the British Medical Association and prior to that a lawyer in local government service.

He holds degrees from Cambridge, London and the Open University.

Dr Adil Akram

Adil is a consultant psychiatrist at South West London and St George's Mental Health NHS Trust. He is also an honorary senior lecturer at St George's, University of London. He has published on perinatal psychiatry, parenting with mental illness and the social care needs of women with mental illness. He has qualifications in healthcare education and mental health research. In addition, he has a longstanding interest in genetics and medical ethics from his student days at the University of Cambridge. He has significant experience of dealing with complex ethical dilemmas and risk assessment.

Adil is also a judicial officer and medical member of the first tier tribunal service, hearing detained patient appeals under the Mental Health Act. He has detailed knowledge and experience of legislation relevant to mental health. He has worked with the General Medical Council to help write and develop tests of competency. He is keen to contribute to public service, as demonstrated by his time volunteering as a psychiatrist at the London 2012 Olympic Games. He is also a shadow governor of the NHS Trust where he works, leading Merton crisis resolution and home treatment team. Adil is also an associate with Cognacity Consulting.

Dr Daniele Bryden

Daniele is a medically qualified consultant in intensive care medicine and anaesthesia working in Sheffield Teaching Hospitals NHS Foundation Trust. She regularly deals with ethical issues in

relation to her clinical role, particularly around consent, capacity and end of life care. She also teaches medical students about ethics, the law and its application to clinical practice. She has a law degree and a masters in medical law.

Daniele has significant committee experience, including membership of the National Institute for Health and Care Excellence (NICE) Technology Appraisal Committee, examination committees for two medical Royal Colleges and an oversight role on a General Medical Council (GMC) Board. She has also sat on GMC appeals panels and works as a clinical assessor, a role that requires discretion and good judgement.

Dr Alan Clamp

Alan is the Chief Executive of the Security Industry Authority (SIA), a regulatory body sponsored by the Home Office. He was previously the Chief Executive of the Human Tissue Authority, and has also held senior positions at the Qualifications and Curriculum Development Agency (QCDA) and Office for Standards in Education, Children's Services and Skills (Ofsted).

Alan's experience in inspection and regulation is complemented by a background in science, including a PhD in clinical biochemistry. He also holds non-executive roles as the Director of an academy and as a member of the Qualifications Committee at the Bar Standards Board.

Dr Nina Hallowell

Nina has recently been appointed as a Senior Researcher at the Ethox Centre, Nuffield Department of Population Health, University of Oxford, where she will be involved in a programme of research on ethical issues arising from the use of big data. She has over 20 years of experience of undertaking research on the social and ethical implications of the introduction of genetic and genomic technologies in medicine, and has published widely in this field. She has qualifications in social sciences and medical law and ethics. She taught ethics at the University of Edinburgh and has been a member of a number of research ethics committees in Edinburgh, Cambridge and Newcastle.

Dr Christopher Harling, CBE

Kit retired from his career as a consultant physician in occupational medicine, Director of NHS Plus, and Senior Policy Adviser at the Department of Health in 2011. He has been a member of a number of medical advisory bodies, particularly concerning blood-borne viruses. He has a particular interest in medical ethics having chaired his specialties Ethics Committee for eight years and published guidance and book chapters in UK and Europe. He has also taught ethics to postgraduate medical students.

Since retirement, Kit has completed a masters degree in marine biology at Plymouth University and continues to undertake research on the prevention of marine growth on immersed structures.

Professor David Latchman, CBE

David is Master of Birkbeck College, University of London. He is also Professor of Genetics at Birkbeck and University College London (UCL).

He gained his degree at Cambridge in natural sciences tripos specialising in genetics, followed by a PhD. Following a career at UCL, culminating in Dean of the Institute of Child Health (UCL) where he was also Professor of Human Genetics, he was appointed Master of Birkbeck in 2003.

In his role as Master of Birkbeck, David serves on a number of committees including the Board of London First, Universities UK (UUK) Board and the Research Policy Network.

He was appointed a Commander of the Order of the British Empire in 2010 for services to higher education.

Carol Moore, CB

Carol worked as a civil servant in the Northern Ireland Civil Service (NICS) from 1974 to 2011. As a senior civil servant, she made a significant contribution to local public service strategy, policy, and organisational effectiveness and efficiency, in functions as diverse as policing, criminal justice, culture, arts and human resources. Her most recent posts were Director of Criminal Justice (Northern Ireland Department of Justice) and Director of Policing and Security (Northern Ireland Office). She is therefore familiar with developing policy and strategy in sensitive, political environments.

Carol has considerable experience relevant to the work of the EG from her role as Director of Central Personnel for the NICS, in particular knowledge of human rights legislation and employment law in relation to discrimination. She also represented the Northern Ireland Department of Justice on the National DNA Database (NDNAD) Strategy Board for just over a year, giving her a good understanding of the technical, legal and ethical challenges surrounding the UK NDNAD.

Since her retirement, Carol has continued to contribute to public life by providing consultancy support to some Northern Ireland government departments. She also serves as an independent assessor on behalf of the Office of the Commissioner for Public Appointments (Northern Ireland) and as a member of both the Board and the Governance Committee of Northern Ireland's largest mental health charity, Praxis, which provides services across the UK and Republic of Ireland.

Isabel Nisbet

Isabel has a strong academic background in moral philosophy, with additional knowledge of medical law and ethics.

Isabel has previously held a variety of senior posts in the Civil Service, and then moved on to work in the regulation of medicine and education. She has held chief executive and director positions at several statutory regulatory bodies (including Ofqual and the General Medical Council), giving her extensive experience of dealing with complex and sensitive human rights, fairness and public confidence issues.

She is a member of the National Statistician's Data Ethics Group and of the Board of Qualifications Wales (the regulator of examinations and qualifications in Wales). She serves on the Boards of Governors of two higher education institutions (the University of Hertfordshire and the British School of Osteopathy). She is also a member of the British and Irish Ombudsman Association and from 2004 to 2011 she was an independent member of the Council of St George's Medical School.

Professor Barbara Prainsack

Barbara has a PhD in political science, and is Professor of Sociology in the Department of Social Science, Health and Medicine at King's College London. She is also an Honorary Senior Research Fellow at the Department of Twin Research and Genetic Epidemiology, St Thomas' Hospital. She has previously held a number of other academic positions.

Her academic interests involve exploration of the ethical, regulatory and social dimensions of biosciences, with a special emphasis on genetic technologies. In particular, she is interested in DNA technologies in criminal justice and crime prevention and in medical research and practice. She is the author of a book discussing prisoners' views of DNA evidence (with Helena Machado, PT) and has edited a book on the governance of forensic DNA databases across various jurisdictions. She has also produced several publications addressing issues such as the use of 'racial' categories in DNA-based identification, and transnational bioinformation exchange.

Since 2009, Barbara has been a member of the Austrian National Bioethics Council advising the federal government in Vienna. This has included leading working groups and formulating recommendations. She was also a Fellow at the Nuffield Council on Bioethics in 2011.

Professor Jennifer Temkin

Jennifer is a legal academic and barrister who is (2016) Emeritus Professor of Law at the University of Sussex, and Professor of Law at City Law School, City University London. She has previously held academic positions at the London School of Economics, the University of Buckingham and the University of Toronto.

Her academic focus is on criminal law and criminal justice, specialising in the area of sexual offences. She has completed a number of empirical studies underpinned by an ethical approach. She now teaches a course at City Law School entitled 'Forensic Science and the Legal Process', which includes the role of DNA and the legal structures surrounding it. This gives her a good understanding of the moral, legal and ethical issues surrounding the National DNA Database (NDNAD).

Jennifer was a member of the Pigot Committee set up by the Home Office to look into child witnesses in sexual offence cases, the external committee of the Home Office Sexual Offences Review, and the Justice Committee on Sexual History Evidence. She is a Master of the Bench of the Middle Temple and a Fellow of the Academy of Social Sciences.

Glossary

Biometric Information	Information about an individual's physical characteristics such as fingerprints or eye colour, which are distinctive and measureable.
Biometrics Commissioner	Independently appointed post to provide oversight of the regime established by the Protection of Freedoms Act to govern the retention and use by the police in England and Wales of DNA samples, DNA profiles and fingerprints. The post has a UK-wide oversight function as regards their retention and use by the police on national security grounds.
Central Elimination DNA Database (CED)	A centrally held database of DNA profiles taken from individuals who are involved in a role where there is a increased risk that they may inadvertently contaminate a sample taken from a crime scene with their own DNA, such as manufacturing or laboratory staff, crime scene officers and police personnel.
Counter Terrorism (CT) DNA Database	A DNA database operated by the Metropolitan Police Service which contains the DNA profiles obtained through searches, crime scenes and arrests in relation to counter terrorism.
Crime Scene Stain	Biological material recovered from the scene of a crime from which DNA may be able to be extracted.
Criminal Justice Sample	A sample of DNA obtained compulsorily from people arrested by the police for a recordable offence under the provisions of the Police and Criminal Evidence Act 1984.
Crown Prosecution Service (CPS)	Established in 1986, it prosecutes criminal cases investigated by the police in England and Wales. It advises police, reviews cases submitted by the police and prepares and presents papers for cases in court.
Custody Images Review (CIR)	Review by the Home Office to consider proportionality of the use and retention of images on a national database.
Data Linkage	A process which brings together two or more sets of data from different databases, organisations or countries to enhance the information that can be obtained from the data (e.g. by combining different datasets, new patterns may become apparent)

Deoxyribonucleic Acid (DNA)	The chemical in the cells of an organism that carries that organism's heritable material used in the development, functioning and reproduction of all known living organisms. DNA is a nucleic acid and consists of two strands coiled around each other to form a DNA double helix. Each DNA strand is composed of smaller units called nucleotides and the sequence of these nucleotides encodes biological information.
DNA Profile	A numerical representation of the characteristics of certain sections of (typically non-coding) DNA obtained following the analysis of a DNA sample which can be uploaded to a database and compared with other DNA profiles.
DNA 17 Profile	A profile produced using the latest system of DNA profiling technology which examines 16 sections of DNA, plus a gender marker to produce a numerical DNA profile that can be loaded onto the National DNA Database. The methodology used creates greater discrimination between profiles than the previous SGM + methodology and reduces the probability of chance matches between individuals.
Elimination DNA sample	A DNA sample taken from an individual and used to create a DNA profile in order for that individual to be eliminated as the source of a sample found at a crime scene [see also <i>Central Elimination DNA Database</i>]
Facial Recognition System	A computer application capable of identifying or verifying a person from a digital image or a video source by comparing selected facial features from the image with those on a facial database.
Familial Searching	Involves searching the database for DNA profiles that do not match fully to a comparison profile, but where an unusually high number of loci match. This could indicate a biological relationship such as parent, child, sibling, cousin, uncle etc.
Forensic Science Regulator (FSR)	Ensures that the provision of forensic services across the criminal justice system is subject to an appropriate regime of scientific quality standards. The FSR works with the Home Office.
Low copy number (LCN)	A modified version of DNA profiling that is performed when the amount of DNA recovered from a biological sample is very limited. The number of PCR cycles is increased compared to standard SGM plus, which enhances the sensitivity of the technique and improves the likelihood of detecting DNA.

Mixed DNA Profile	A profile where DNA from more than one individual is present. A mixed DNA profile is evident when more than two copies of DNA are observed at a region. [See also <i>DNA profile</i>]
National DNA Database (NDNAD)	Established in 1995, it is an electronic, centralised database holding the DNA profiles taken from both individuals and crime scenes. The database can be searched to provide police with a match linking an individual to a crime scene and <i>vice versa</i> .
National DNA Database Delivery Unit (NDU)	A department within the Home Office responsible for overseeing the running of the National DNA Database.
National DNA Database Strategy Board (NDNAD SB)	A board comprising representatives from NPCC, the Home Office, the DNA Ethics Group and the Forensic Science Regulator as well as representatives from other bodies that provides governance and oversight for the operation of the NDNAD.
National Police Chiefs' Council (NPCC)	The NPCC bring together the 43 operationally independent and locally accountable chief constables and their chief officer teams to coordinate national operational policing. They work closely with the College of Policing.
Next Generation Sequencing (NGS) or Massive Parallel Sequencing (MPS)	This is the term used to describe a number of high throughput approaches to DNA sequencing that allow the sequencing of DNA much more rapidly and cheaper than previously.
ParaDNA® Instrument	An instrument that can be used at a crime scene and is able to produce a DNA profile from a sample within 75 minutes. ParaDNA® profiles include 5 STRs and a gender test and therefore the discrimination power provided from these profiles are much less than obtained from full SGM+ and DNA17 profiles. [See also <i>Rapid DNA Technology</i>]
Partial DNA Profile	This is the term used to describe a profile when results have been obtained at some but not all of the sections of DNA which were analysed. Partial profiles are often obtained from samples recovered from crime scenes as the DNA may have been subject to conditions which have degraded it, which means that not all regions of DNA of interest are intact.
Phenotype	The physical manifestation of an individual's genotype combined with the effects of exposure to environmental factors (e.g. the hair colour, facial features, or personality traits of a person)

Phenotypic profiling	The use of DNA analysis in order to obtain information about externally visible traits, and/or the likely ethnic background, of a person. The information cannot be obtained from traditional STR profiles but requires a special type of analysis.
Protection of Freedoms Act (PoFA)	An Act of Parliament of the UK which was introduced by the Home Secretary in 2011 and sponsored by the Home Office. In May 2012 the Bill completed its passage through Parliament and received Royal Assent.
Prüm Agreement/ Convention	A convention signed in May 2005 by Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Spain and is open to all members of Europe and enables the signatories to be able to exchange data regarding DNA, fingerprints and vehicle registrations of persons suspected to be co-operating in terrorism, cross-border crime and illegal migration.
Random Match Probability	The probability that a DNA profile matches a randomly drawn person from the general population. If the random match probability is high, then any suspected link between the DNA and a person needs to be treated with caution.
Rapid DNA Technology	Technology which has the ability to produce a DNA profile much faster than can be done using conventional technology and is also portable.
S and Marper	This refers to a case where S joined with Marper to bring a case to the European Court of Human Rights after their applications to the English courts had failed. They objected to the retention by the police of their DNA samples, profiles and fingerprints as they had not been convicted of any offence. The police were entitled to retain them under the law then in force. S and Marper relied principally on Section 8 of the European Convention of Human Rights which protects the right to privacy. The Court found in their favour. It held that the margin of appreciation had been exceeded and their right to privacy had been infringed. This decision led eventually to the passing of the Protection of Freedoms Act 2012 which changed the law on the retention of samples, profiles and fingerprints. This in turn led to the removal of millions of profiles from the National DNA Database.

<p>Second generation multiplex (SGM, SGM+)</p>	<p>A system of DNA profiling which was used in the UK until July 2014 which examines 10 sections of DNA plus a gender marker to produce a numerical DNA profile that can be loaded onto the National DNA Database. At each of the 10 areas an individual has two copies of DNA, one inherited from each of their parents.</p>
<p>Short Tandem Repeat (STR)</p>	<p>Sections of DNA dispersed within coding and non-coding regions of the human genome that contain hundreds of repeats of a short sequence of DNA (2-6 nucleotides). Different people have different numbers of repeats and when a number of regions are analysed, the chance of two people having the same number of repeats at all loci is small. This is the underlying principle of DNA profiling.</p>
<p>Single Nucleotide Polymorphism (also referred to as SNPs – pronounced “snips”)</p>	<p>This is a variation at the level of single nucleotide bases that occurs at a specific position in a sequence of DNA.</p>
<p>Y-STR profile</p>	<p>See <i>STR profile</i> but restricted to regions found only on the Y-chromosome (which is only present in males).</p>

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