

This response was submitted to the consultation held by the Nuffield Council on Bioethics on *The Forensic use of bioinformation: ethical issues* between November 2006 and January 2007. The views expressed are solely those of the respondent(s) and not those of the Council.

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QUESTIONS ANSWERED:

Question 1: The interpretation of bioinformation

ANSWER:

The probability of a chance match between unrelated individuals using SGM+ is on average less than one in a billion. Although no chance matches between two SGM+ genotypes have been observed as of yet, with an increasing number of DNA profiles in NDNADB it will be increasingly likely, especially when partial profile searches are performed. Additional typing strategies can be employed e.g. Y-STR or mitotyping (mtDNA), however these are less discriminatory and may show strong geographical bonding. Haplotype (Y-STR and mtDNA) analysis may be useful for reducing the number of candidate matches identified by familial searching. Furthermore, inclusion of mtDNA may benefit the analysis of degraded DNA, in conjunction with successfully typed STR markers. The FBI uses thirteen core loci for the Combined DNA Index System (CODIS) database, while in the Thai Tsunami a set of 15 loci was used. Indeed, the number of loci required for the Tsunami identification effort reflected the requirement for familial searching among the victim's body samples for the association and identification of bodies. From this, one may argue that expansion of the DNA Database with additional markers is inevitably, considering that the number of victims in the Tsunami is ~1/15 of the number of DNA profiles stored in the NDNADB. Considerations for expansion of the current SGM+ markers with an additional set of STR markers include the following. Re-typing of samples may be a costly procedure. With the transition of the SGM to SGM+ kit, only profiles showing a match have been upgraded to SGM+. A considerable proportion of profiles in the DNA database still have 6 SGM markers (Parliamentary Office of Science and Technology, 2006). Furthermore, addition of a set of markers should be conducted in international agreement to maintain compatibility and transferability with other national DNA databases and laboratory standards. The Interpol Handbook on DNA Data Exchange and Practice provides guidelines on this matter (available at <http://www.interpol.int/Public/Forensic/dna/handbook.asp>). The markers should be validated for forensic purposes. There has been debate as to which extend a set of additional SNPs may aid STR analysis in national DNA Databases (Gill et al., 2004). Gill, P., Werrett, D.J., Budowle, B., Guerrieri, R., An assessment as to whether SNPs will replace STRs in National DNA Databases (2004) *Sci Justice* 44 (1), pp. 51-53 Parliamentary Office of Science and Technology (2006). Postnote. number 258, February 2006,

Question 3: The management of the NDNAD

ANSWER:

There has been debate about how long profiles and DNA samples should be retained. The criteria for the retention of DNA profiles and samples varies considerably between various European countries (see Report on ENFSI member countries DNA database legislation survey, 2006). The effectiveness of retention policy (prior to the Criminal Justice and Police Act, 2001) in England and Wales has been demonstrated: "As of 31 March 2005 it is estimated that there are around 198,000 DNA profiles on the Database which would previously have fallen to be removed. From these, approximately 7,591 profiles of individuals have been linked with crime scene stains involving 10,754 offences. These offences include 88 murders, 45 attempted murders, 116 rapes, 62 other sexual offences, 91 aggravated burglaries and 94 offences of the supply of controlled drugs" (Scottish Executive, 2005) It can be argued that only ~3.8% (7.591/198.000) of these

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profiles was linked to a crime and conversely 96.2% has been stored without purpose. Ross (2005) stated "It is arguable that the general retention of profiles from the un-convicted has not been shown to significantly enhance criminal intelligence or detection" However, the seriousness of some offences should be taken into account. Furthermore, one of the purposes of the NDNADB is the prevention of crime. Inclusion on the database, and knowing that crimes may be linked, may prevent other crimes being committed by an offender. Re-offending should be considered. Offenders who committed a minor offense may do so later again in life, or change to more serious offences. Different approaches are seen in various European countries. Some countries remove profiles and destroy DNA samples after death of the submitters, while others review the retention of profiles/samples after a certain period of time (depending on age/ or type of offence). Indefinite retention may be the most effective way to detect re-offenders. There are risks of retention of samples/profiles after a certain period of time e.g. the offender can commit a more serious crime after data has been removed. Also, if a correlation between epigenetic disposition and criminal behaviour exists (e.g. see Nathan, 2004), indefinite retention facilitates familial searching if the progeny of the individual whose DNA is stored on the NDNADB starts offending, even if the parent has not committed an offence for a considerable time. One can argue that indefinite retention of elimination samples may have an adverse negative effect on the voluntary submission of DNA, and hence on the purpose of such policing tools e.g. solving crimes. Volunteers should be able to limit their consent for the use of their profile and samples to the investigation and prosecution of that specific offence only. If no consent is given by the volunteer for the retention of the profile and/or sample, the profile should be removed and the sample destroyed after the volunteer is eliminated from the enquiries. If consent is given, the volunteer should be allowed to withdraw at any time, given that he/she has not committed a reportable crime. refs. Nathan, G.(2004) Crime and the family: like grandfather, like father, like son? British Journal of Forensic Practice.

Question 4: Ethical Issues

ANSWER:

a. One can argue that, given the definition of the purpose of the NDNADB, familial searching is a valid tool for crime detection. Article 17.1 of The International Covenant on Civil and Political Rights however states that "No one shall be subjected to arbitrary or unlawful interference with his privacy, family, home or correspondence.." (United Nations, 1966: 7) which recognises the right of (family) privacy with respect to governmental interference. The UK is a signatory of this Covenant. One can hence indeed argue that familial searching is an invasion of family privacy. However, the use of familial searching is limited to serious offences such as homicides and serious sexual offences. The benefits of using familial searches for potentially solving such offences should weigh higher than privacy concerns. For minor offences, invasion of privacy (and civil rights) versus the potential to solve the crime is subject to debate. Criteria for using techniques considered 'invasive' (such as familial searching) should be set out to allow for more transparency as to when and under which circumstances such methodologies can be used. It should be noted that with the increasing number of DNA profiles stored in the NDNADB, the value of familial searching may decrease. For parent-progeny searches, only one allele per locus is inherited, while for full siblings there is a 1/4 chance of sharing the same allele. This may result in many potential matches in the database, and it can hence be argued if familial searching is beneficial for the inquiry in its present form. Additional search strategies, such as Y-STR or mtDNA data, may reduce the number of potential matches identified by familial searching. b. The question here is not

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if the bias is acceptable, but rather why the specific groups are disproportionately represented in the NDNADB. Indeed, one can argue that young males are more likely to commit (minor) offences than young females, and hence are more likely to have their DNA retained in the database. It can be debated that this is merely a representation of the offender population. For example, it can be seen that in 2002 male offenders in England and Wales outnumbered female offenders by more than four to one (Crime in England and Wales, 2002/2003, Home Office). With respect to the over-representation of ethnic minorities, it has been mentioned that some ethnic minorities have been specifically targeted (e.g. see <http://news.bbc.co.uk/1/hi/uk/4584000.stm>). This will remain a controversial subject, which will continue to exist. Such debates however undermine the public's perception of the DNA database.

c. One can argue that indefinite retention of elimination samples may have an adverse negative effect on the voluntarily submission of DNA, and hence on the purpose of such policing tools e.g. solving crimes. Volunteers should be able to limit their consent for the use of their profile and samples to the investigation and prosecution of that specific offence only. If no consent is given by the volunteer for the retention of the profile and/or sample, the profile should be removed and the sample destroyed after the volunteer is eliminated from the enquiries. If consent is given, the volunteer should be allowed to withdraw at any time, given that he/she has not committed a reportable crime.

d. Collection of DNA from everyone at birth will likely be viewed by many as a safeguard against discriminatory policing and 'fair' collection of data under the Data Protection Act. The following should however be considered. In paternity disputes, in which one of the parents refuses to submit DNA evidence for the child and/or their own DNA, the DNA Database may be used to obtain the profiles in question. Also, special consideration should be given to children from parents with an UK passport born abroad and how DNA will be collected from them. Also, questions as to who should process the DNA samples taken at birth/or registration. In 2005, 722,500 children were born in the UK (National statistics online, 2005), on average ~2000 children a day of which DNA should be processed. Furthermore, if children are born abroad, who ensures that the same Quality Standards are maintained as in the UK or should special provisions be made to include children born in the UK only. One may also need to consider the possibility of identity fraud e.g. is the DNA sample from the child indeed that of the parents who registered the birth. The profiles of the parents may need to be verified as well, which may lead to potential problems if one of the presumed biological parents is not the legitimate parent. Another argument is the potential benefit for the retention of DNA profiles and samples from everyone at birth e.g. how likely is it that a child till the age of say 8 will commit a (minor) offence. A similar debate may result as to why profiles of volunteers and suspects acquitted of a crime should be stored. It can also be argued that if DNA samples are retained at birth, are special provisions needed to collect DNA samples from the population who has not been included in the database as well, and how should UK citizens abroad be included in the database. Collection of DNA at birth has an advantage. In disasters, direct reference samples of the missing person (e.g. tooth brush, comb etc) may not be available. As an alternative approach, indirect references submitted by biologically related individuals can be used. Ideally, parentage trios are obtained, that is a set of reference samples from both parents and their progeny. Collection of these reference samples may however cause additional distress for the relatives of the victims and can be perceived as invasive to the relatives. Storage of all profiles on the NDNADB may however solve this problem as DNA profiles can be searched without such an invasive procedure (perhaps only consent of the relatives that their DNA profiles can be searched for identification purposes).

refs. Office for National Statistics, General Register Office for Scotland and Northern Ireland Statistics and Research Agency, (2005) <http://www.statistics.gov.uk/cci/nugget.asp?ID=951> (accessed 10/01/07) United Nations (1966) Article 17.1 of The International Covenant on Civil and Political Rights Home Office (2003) Crime in England and Wales 2002/2003 and Home Office (2001) Criminal Statistics, England and Wales, http://www.statistics.gov.uk/cci/nugget_print.asp?ID=442(accessed 10/01/07)

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Question 5: The evidential value of bioinformation

ANSWER:

b. DNA evidence is valuable in the elimination of suspects or supporting other evidence. Other evidence supporting the DNA evidence is always required to prove guilt. How much evidence is required should be judged on a case-to-case basis. It also depends on how a DNA match is obtained (e.g. by familial searching or intelligence match, database search without prior knowledge of the defendant or defendant was known prior to database search). In addition, the type of non-genetic evidence is of importance e.g. fingerprints or specific fibres which link the suspect to the crime scene may be more relevant than an eye witness account. Above all, the principle of 'beyond reasonable doubt' should be endorsed. Both scientific and non-scientific evidence may be relevant, even though some evidence is difficult to quantify e.g. in the form of a likelihood ratio. The FBI has adopted a rule that it will give a positive identification (like fingerprint evidence) when the likelihood ratio exceeds 260 million, approximating the US population. By using this approach, one assumes that if the likelihood ratio > 260 million, no other individual has the same DNA profile in the US population and hence, this profile must belong to the suspect. Needless to say, the CODIS database does not contain DNA profiles of the entire US population, and hence, such an assumption cannot be reliably validated. As long as the extent of genetic population variation is not fully investigated (and hence "uniqueness" of a DNA profile in a particular population), other evidence should be used in support of the DNA evidence.

Question 6: Other issues

ANSWER:

I would like to raise the issue of the potential uses of bioinformation for the identification of a deceased person or a body part e.g. in a disaster. The Serious Organised Crime and Police Act 2005, by amendment of the section 64 of the Police and Criminal Evidence (PACE) Act 1984, enabled DNA samples taken from a person's body or body part to be checked against the NDNADB or NAFIS (National Fingerprint Identification System). As mentioned previously in this consultation paper, some physical characteristics may be inferred from a DNA profile e.g. gender, red hair and, to some extent, eye color and ethnic origin. Although accurate inferences cannot be made as of yet, the potential for mass disaster victim identification should be considered in the future when more reliable inferences can be made (or predicted). Inference of characteristics such as eye, skin and hair colour and dispositions for genetically transmitted diseases from decomposed, skeletalised remains or body parts may be beneficial for establishing the identity of remains in missing person investigations and disaster. In addition to already raised ethical issues such as disclosure of unsuspected family relationships or an illegitimate parent, other potential issues should be considered. These include discrepancies between the inferred physical characteristics from genetic material and data of the potential victim stored in the DNA database. Also the disposition of genetic diseases previously unknown to the biologically related individuals of the presumed missing person. Except for the TH01 locus, no markers have been associated with a genetically transmitted condition. Indeed, if such techniques become available in the future, and disposition for diseases or physical characteristics can be accurately predicted from body samples, one may start to argue that the retained DNA samples should be used to verify the characteristics to establish positive identification (if a match is suspected between the body sample and a database match). Although it may still be too early to hypothesize on these matters, it shows how difficult it will be to ensure the integrity of the NDNADB while considering other purposes of public interest in the future. A framework may need to be established into exact which procedures are allowed for DNA based identifications. In my opinion, definitions such as "prevention of crime", "detection of

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crime" and "identifying a person's body or body part" are subject to a wide range of interpretations as to what is allowed in reaching those goals and as to when the balance between civil rights and policing benefits is reached. A further consideration is the potential for 'name-searching' by correlating surname and Y-STR haplotypes, both transmitted patrilineally (Jobling, 2001). Although this method has of yet shown poor correlations, this method may provide an additional tool for familial searching in the future. Another issue which may be useful to consider is the establishment of a framework of what kind of research can be carried using data from the NDNADB. Should the database be maintained by different parties to avoid DNA profiles using exploited for 'forensic' research, e.g. one organisation maintains the integrity of the DNA profiles (without ANY identification data to which the submitter of the profile can be identified) while the identification data (e.g. name, sex, age, DOB etc) is stored and maintained by another organisation. Also, how can the influence of drug companies or other interested parties with an commercial interest in data from the NDNADB be restricted in the future. Such parties could include companies who are interested in using the NDNADB for employer screening or research in genetic dispositions for criminal behaviour etc. As of yet, retained DNA samples are stored by the laboratories who typed them, but are owned by the police. How are these laboratories regulated and compliance to these regulations ensured with respect to DNA retention and how can be prevented that samples are being used for commercial or other purposes by the laboratories. Again, limits as to what kind of research is allowed, with clear definitions as to what constitutes "the prevention" and "detection of crime" in relation to civil liberties, should be defined. Transparency and a clearly defined framework as to how the DNA samples can be be used is needed to restore and maintain public confidence in the NDNADB. refs. Jobling, M.A. In the name of the father: surnames and genetics. *Trends Genet.* 17, 353–357 (2001).