

DNA Databases for Offender Identification in Europe — The Need for Technical, Legal and Political Harmonization

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In 1995, a national database has been established quite successfully in the U.K.. It is being used for the identification of suspects using short tandem repeat (STR) typing results from casework as well as from reference DNA samples obtained from suspected and convicted offenders. The introduction of multiplex PCR typing systems allowing the simultaneous analysis of ten independent loci or more greatly facilitates the rapid typing of samples and computer-based storage of results in large DNA profile databases. However, in order to introduce such a database as well at the European level, it must be recognized that the legal systems in the member states of the European Union are quite diverse and may not allow the storage of personal genetic data for the purpose of criminal investigation. At present, there is still a significant heterogeneity among the European countries already concerning the possibility to obtain DNA samples from suspects and the acceptance of DNA evidence in casework [for review, see ref. 1].

There is no generally agreed model regarding the organisational structure of a national DNA database. Therefore, Fig. 1 may serve as an example for such a database exhibiting typical features which should ascertain the efficient use in criminal investigations and at the same time provides a maximum of data protection and quality assurance for the DNA profiles entered. This model is divided into three separate organisational areas: the DNA database with profiling laboratory for typing and storage of anonymous DNA samples collected from offenders only for the purpose of database searches; an independent database only for storage of personal records and identification tags used to anonymize the DNA data-

base samples; the police carrying out routine casework investigations on crime scene samples.

Thus, the database is completely separated from casework investigations only serving as an intelligence tool for offender identification. The typing of reference samples from known offenders submitted to the database has to be subjected to rigorous internal quality control and quality assurance procedures to avoid storage of unconfirmed or erroneous typing results, as these could lead to a wrongful exclusion of a perpetrator. In a criminal investigation regarding the origin of an unknown crime scene sample, DNA typing would be carried out in a routine lab on behalf of the police, and the results would then be submitted to the database for a search against the profiles of known offenders (person-to-scene match) or against other samples from unsolved crimes (scene-to-scene match). If a match is found, the database lab can retrieve the stored reference sample for a confirmatory analysis before forwarding the respective ID code to the personal database. The police unit carrying out the case investigations will then be informed about the identity of the suspect. If arrested, a fresh DNA sample has to be obtained from the suspect for further investigations and to serve as evidence in court.

At present, national DNA databases are in operation in 4 European countries. Plans for a database are at different levels of preparation in 8 more countries. Only 4 countries do not plan to introduce a database in the near future (see Table 1). At the political level, a decision has been reached in 1997 between the members of the European Union to create a framework for a European DNA Data-

Table 1: DNA Databases in Europe

Database in operation	Date of introduction	Database in preparation	Date of legislation (date of planned operation)	Currently no plans for database
UK	April 1995	Belgium	September 1998	Ireland
Netherlands	1997	Denmark	?	Italy
Austria	October 1997	Finland	July 1997 (1.1.1999)	Greece
Germany	April 1998	France	end of 1998	Portugal
		Norway	September 1997	
		Spain	?	
		Sweden	January 1999	
		Switzerland	end of 1998	

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base for offenders convicted for sexual abuse of children. To allow the exchange of DNA profiling data for this purpose, agreements have to be reached regarding the typing technology and the selection of standard DNA systems forming the core of the database. Recommendations have been made by the DNA Working Group of the European Network of Forensic Science Institutes (ENFSI – a network of police and government laboratories) and

by Interpol to use the following STR loci as core systems: TH01, vWA, FGA, D21S11. These loci have initially been recommended as suitable for standardization by the EDNAP (European DNA Profiling) Group (a working group of the International Society for Forensic Haemogenetics – ISFH) based on a series of collaborative exercises [2-4].

Table 2: European Countries with DNA Databases in Operation

U.K.	Netherlands	Austria	Germany
Custodian /Location of Database			
Forensic Science Service, central database lab in Birmingham	Dutch Forensic Science Laboratory, Rijswijk	Central DNA Typing Laboratory, Institute of Legal Medicine, Innsbruck	Bundeskriminalamt (BKA), Wiesbaden (Federal Criminal Office)
Samples stored and entry criteria			
<u>DNA profiles and reference samples</u> of: - suspects - convicted offenders - unknown samples for "any recordable offense"	<u>DNA profiles</u> only of: - convicted offenders - unknown samples for serious crimes with 2 years imprisonment or more after <u>court order</u>	<u>DNA profiles</u> and <u>DNA reference samples</u> of: - suspects - convicted offenders - unknown samples, for crimes against life and health, sexual abuse, robbery, theft, arson, blackmail, drug-related and other serious crimes	<u>DNA profiles</u> only of: - suspects - convicted offenders - unknown samples, for serious crimes with one year imprisonment or more, sexual abuse and other serious crimes, at present only for results obtained from routine case-work when DNA typing was ordered by a judge
Anonymization requirements			
anonymous storage of reference samples and DNA profiles, separate register for personal records	anonymous storage of DNA profiles only, separate register for personal records (crime samples can be stored)	anonymous storage of reference samples and DNA profiles, separate register for personal records outside the central DNA lab	open storage of DNA profiles together with personal data, typing of anonymized personal and crime scene samples in police and university laboratories
Removal of entries			
Acquitted suspects only	offenders: after 30 years samples: after 18 years	acquitted suspects only	routine controls for samples to be removed every 5 years
No. of entries (June 1998)			
263,000	offenders: 200 unknown samples: 400	4,500	no statistics available yet
DNA systems used (see also Table 4)			
- Quadruplex - SGM - TGM	- Quadruplex - SGM	SGM	4 European core systems + SE33
Remarks			
	Change of legislation planned to allow entry of offender profiles without court order		Additional legislation proposed to obtain samples from convicted offenders in cases where no DNA typing was carried out during investigation

Table 3: European Countries with Databases in Preparation
(if no information is given, the respective issue is still under discussion)

Database custodian	Entry criteria	Sample storage and removal periods	DNA systems used for typing
Belgium National Institute of Criminalistics, Brussels	Convicted criminals with <u>court order</u> for crimes with 3 years of imprisonment or more	<u>DNA profiles</u> only from – convicted offenders – unknown samples, removal after 30 years	4 European core systems + at least 3 additional STR systems (not yet defined)
Denmark University Institute of Forensic Genetics, Copenhagen	no details available yet, a commission report has been submitted to the parliament		
Finland Crime Laboratory, National Bureau of Investigation, Vantaa	Suspects for crimes with 1 year of imprisonment or more, for offenders convicted before 1.7.97 also retrospectively if still held in prison	<u>DNA profiles</u> and <u>DNA reference samples</u> from – suspects – convicted offenders – unknown samples, removal after 1 year if suspect is acquitted, legal limit for data storage 10 years (law may be changed for DNA profiles)	Promega or ABI multiplex STR systems, no final decision yet
France	Sexual assault on children		
Norway University Institute of Legal Medicine, Oslo	Convicted criminals with <u>court order</u> for sexual abuse, crimes against life and health, crimes posing danger to the public (e.g. arson), blackmail and robbery	<u>DNA profiles</u> only from – convicted offenders – unknown samples, no removal except after death or proven innocence	ABI SGM Plus likely, no final decision yet
Spain	Legislation had been proposed in 1995 and was rejected. It will be presented again in a few months.		
Sweden SKL – National Institute of Forensic Science, Linköping	Convicted criminals for crimes with 2 years of imprisonment or more	<u>DNA profiles</u> only from – convicted offenders – unknown samples, removal 10 years after release from prison (without further offense)	ABI Profiler
Switzerland University Institute of Legal Medicine		<u>DNA profiles</u> and <u>DNA reference samples</u> may be stored, removal periods are under discussion	ABI Profiler (Plus) likely, no final decision yet

The surveys from Table 2 (databases in operation) and Table 3 (databases in preparation) represent the situation of DNA database projects in Europe in June 1998. In a number of countries, no final decisions have been made yet, or changes may still be possible to the information given here.

Regarding the system standardization, most countries are using or planning to use either the SGM (second generation multiplex) developed and used by the Forensic Science Service (FSS) for the U.K. National DNA Database, or multiplex PCR systems offered by commercial companies like Promega or Applied Biosystems (for

Table 4: Composition and properties of STR multiplexes selected for databases

Multiplex kit/loci	STR system composition	Chance for a random match
SGM	TH01 ⁺ , vWA ⁺ , FGA ⁺ , D8S1179, D18S51, D21S11 ⁺ , AMG	1 in 50 Million
ABI Profiler*	TH01 ⁺ , vWA ⁺ , FGA ⁺ , TPOX, CSF1PO, D3S1358, D5S818, D7S820, D13S317, AMG	1 in 3.5 Billion
ABI SGM Plus	TH01 ⁺ , vWA ⁺ , FGA ⁺ , D2S1338, D6S477, D8S1179, D16S539, D18S51, D19S433, D21S11 ⁺ , AMG	more than 1 in 100 Billion
German database loci	TH01 ⁺ , vWA ⁺ , FGA ⁺ , D21S11 ⁺ , SE33	1 in 10 Million
European core loci	TH01 ⁺ , vWA ⁺ , FGA ⁺ , D21S11 ⁺	1 in 100,000

⁺ European core systems; * a different composition will be made available which also includes D21S11

further details, see other contributions to this volume). As these multiplexes comprise a number of common and different loci, efforts are being made to include at least the four European core systems in all multiplexes offered. All commercially available kits also contain the XY-chromosomal Amelogenin locus (AMG) suitable for male/female detection. Nevertheless, the discrimination power of the four core loci is much less compared to the systems selected in national database projects (see Table 4). This may limit the future use of some of the national databases at the European level. The concept of "uniqueness" of a DNA profile in a database which was the basis of decision for selecting 13 STR loci in the United States for the national CODIS database, has not been adopted yet by most of the European countries.

In all European countries, specific legislation was required for the creation of national DNA databases, as the existing laws either prohibited the taking of a blood or saliva sample from suspects without consent or outside police investigations only for the purpose of a database, or the use of DNA profiling in criminal casework, and the storage of DNA profiles in computerized databases.

The protection of privacy rights at different levels has led to two different database models: in a number of countries, DNA profiles as well as reference DNA samples from suspects and/or convicted criminals may be stored anonymously in a central database facility, which enables a rigorous quality control of typing procedures and results, as well as further internal controls of a matching sample identified in a database search before the information about a match is being disclosed to the police. The storage of reference samples allows also to update database entries for future improvements in typing technology. In contrast, several other countries have decided that these reference samples (but not the crime scene samples) must be destroyed after completion of the typing procedure to prevent any illegal analyses of the genomic DNA samples. In Germany, DNA profiles may therefore

be stored without anonymization in a central police database, but the DNA laboratory responsible for the typing the (anonymized) casework samples has no access to the (non-anonymized) database records to verify the correctness of the entries. In these countries, the current typing technology has to be maintained over the next decades without the possibility of future enhancements for the existing records (except after having obtained a fresh sample again from casework).

Further heterogeneity is observed regarding the crimes which may lead to a DNA database entry, the selection of persons, the basis of decision, as well as the storage periods. Criteria for a database entries may be as follows:

- all suspects or convicted offenders only (with or without a court order),
- retrospectively also for convicted offenders already serving prison sentences,
- for any recordable offense,
- sexual abuse (all cases or children only),
- crimes typically associated with stain evidence (e.g. serial theft, robbery, blackmail),
- severe crimes depending on a minimum period of imprisonment (typically 1-3 years),
- crimes against health and life,
- serious crime (e.g. organized crime),
- crimes causing danger to the public (e.g. arson).

The storage periods are either indefinite (except for acquitted suspects, or convicted offenders with proven innocence in a later trial), or limited to explicit periods between 10 and 30 years starting either from the date of database entry or from the date of release from prison.

This survey emphasizes the need for harmonization of these technical and legal issues at the European level in spite of considerable heterogeneities of the cultural, political and legal conditions among the European countries, which are based on historical developments and a

different national heritage in each country. Nevertheless, the current developments regarding DNA databases represent a significant change in most countries. To further improve the usefulness of this powerful method in criminal investigations, and to respect and protect individual privacy rights at the same time, a continued collaborative effort of scientific and legal experts will be necessary.

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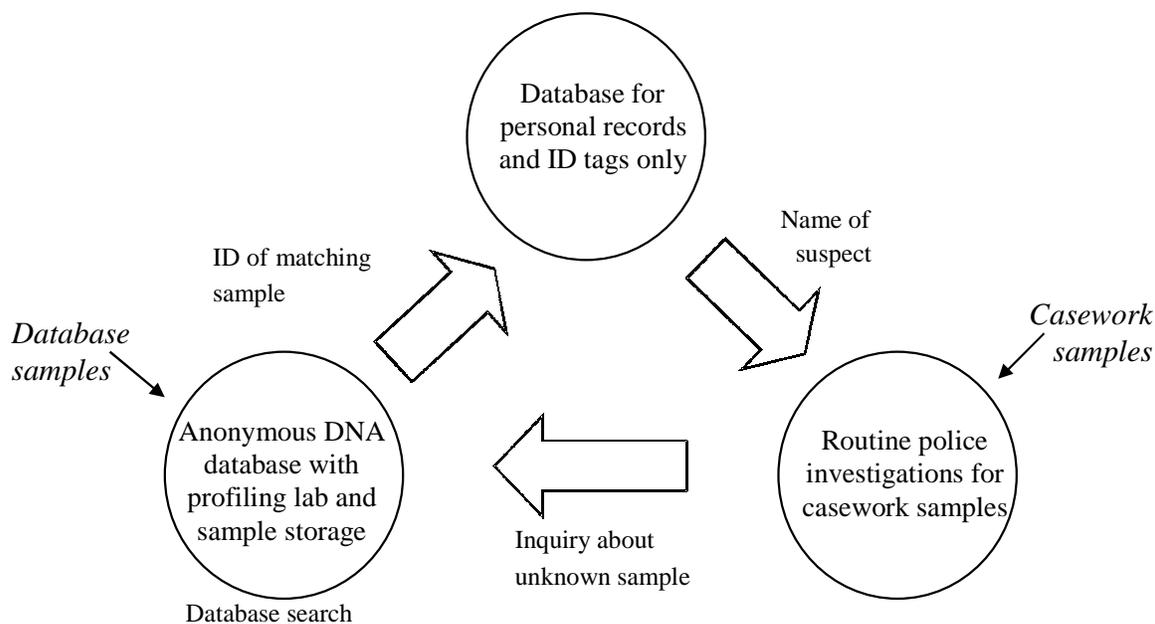


Figure 1: A database model