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EDITORIAL ARTICLE

Organization and operation of the Spanish DNA database[☆]



Organización y funcionamiento de la base de datos de ADN de interés criminal en España

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Genetic analysis of DNA for forensic identification purposes is currently a tool of unquestionable usefulness in judicial research for clarification of criminal offences. The final objective of the genetic test is to individualise it. To do this correspondences have to be established between biological remains and the people who deposited these samples or, in the field of cadaveric research, to establish compatibilities of kinship.

On numerous occasions, comparative analysis is not possible, since there is no known author of the criminal offence, or, in the cases of cadaveric identification, no family members are available. In recent years database (DB) of DNA profiles for genetic identification purposes have proven to be an extraordinarily effective tool in helping to resolve this type of situation.

In the legal and police area, databases offer several advantages. They are a tool of indisputable prevention of future crimes, they fast forward response in criminal case

resolution and they help to conclude unresolved cases and the establish relationships between criminal acts where none are apparent. In the humanitarian field, databases play a major role in situations in which conventional techniques of cadaveric identification fail, due to the violence or magnitude of the crime, or due to the actual condition of the corpses. In these cases, the systematic comparison of several remains to others or with potential family members enables valid identification of the remains or their re-association. Of particular interest is their resolution of situations and accidents in which many victims are involved.

According to the latest report published by INTERPOL,¹ at the end of 2016, 68 of the 89 member countries had national DB which included a total of 35.5 million DNA profiles. This number is even higher if we consider that in this report data referring to the DB of China was not included (68 million, up until 2017). Together with U.S.A., this is the most numerous, with a global estimation of 100 million of DNA profiles.

The legal framework of DNA databases for genetic identification purposes

In 2005 Spain, together with another 6 countries of the European Union (Belgium, Germany, France, Luxemburg, the Netherlands and Austria), signed a treaty of cooperation in Prüm² (Germany) to unite forces in the cross-border fight against organized crime, terrorism and illegal immigration.

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Among other aspects, these countries undertook to create DNA files relating to criminal acts and to exchange them between the undersigned countries. For the last 15 years, other countries have also adopted this treaty. At present Spain is routinely exchanging genetic profiles with another 22 European countries: Austria, Cyprus, Germany, Estonia, France, Lithuania, Latvia, Luxemburg, Holland, Poland, Portugal, Rumania, Slovenia, Slovakia, Sweden, the Czech Republic, Malta, Finland, Hungary, Belgium, Croatia and from September 2019 onwards, with the latest incorporation of the United Kingdom. This exchange of profiles outside our borders allows us to exponentially increase the determination of criminal acts and converts the DB into a significant tool in the struggle against cross-border delinquency. Thanks to this exchange, Spain has generated 9252 coincidences for clarification of crimes from other countries, and has been able to identify 8265 profiles linked with unresolved crimes in internal searches in Spain.³

In 2007, 2 years after the signing of the treaty, Spain approved the Organic Law 10/2007⁴ which governs the police data base on DNA identifiers for criminal purposes and the identification of missing persons in Spain. The articles of the law cover different, relevant aspects. The ultimate aim of this Law is to unify and integrate into a single DB the DNA files generated by the different laboratories of the Security Forces and Agencies and of the Ministry of Justice. The aim of this is two-fold: to research and discover crimes and to identify cadaveric remains or the whereabouts of missing persons. The national DB organically depends on the Ministry of the Interior through the Secretary of State for Security, a body which carries out the complete management of the DB on a national level and which acts as a point of contact nationally for the exchange of profiles on an international level.

On a separate issue, article 4 of the law refers to the type of genetic information which will be the object of registration, establishing that genetic information may be recorded in the police DB which has originated in the framework of the criminal investigation and which exclusively provides genetic information that reveals the identity of the person and their gender.

Furthermore, the inclusion of genetic profiles from evidence is limited to that which had been found or obtained from analysis of biological samples of the suspect, detainee or accused, when there are serious criminal acts, and in any event, when they affect the life, freedom, indemnity or sexual liberty, integrity of the individual, property, whenever they were committed with force, or violence or intimidation of individuals.

One highly relevant aspect included in the law refers to the compulsory indication that the laboratories carrying out this type of genetic analysis be duly accredited, and for this the National Commission for Forensic Usage of DNA (CNUFDNA)⁵ is authorized as the competent authority in this regard. Here, the annual survey conducted by CNUFDNA on the forensic genetics laboratories in Spain is of note, where the results of participation from these laboratories is assessed in international proficiency exercises (GHEP-ISFG and GEDNAP),^{6,7} along with their status of accreditation by the National Accreditation Entity (ENAC), which annually publishes a list of the accredited public laboratories which may record DNA profiles in the police

DB. Furthermore, over the last 10 years of its operation CNUFDNA has developed different scientific and technical guidelines and recommendations to help with the implementation of international standards in the analysis of DNA for forensic purposes.

The legal framework which governs the DNA database in the different countries worldwide differs regarding the degree of established criteria demand for inclusion and elimination of genetic profiles in the DB, and the efficiency and efficacy of the data bases are different in operative terms.

Organisation of the Spanish data base

Management of all the genetic profiles obtained in the different DNA forensic laboratories and cross-over of the data stored automatically between the different institutions in Spain is accomplished with the software developed by the *Federal Bureau of Investigation* (FBI) called CODIS, from the acronym Combined DNA Indexes System, which refers to the indexed search mode upon which this programme is based. CODIS has different levels of access, building a hierarchical tree which adapts perfectly to the DNA forensic laboratory system established in Spain.

The first local level, the Local DNA Index System (LDIS) node, is assigned to each of the operative institutions (National Body of Policy, Civil Guard, Ertzainza, Mossos d'Esquadra, Navarra Police Force and the Spanish National Toxicology and Forensic Science Institute). At this level, the different institutions deposit the genetic profiles generated in their own laboratories with an alphanumeric code and without the information associated with the profile (identification, origin of the sample, judicial procedure, etc.). At this level each institution may develop its own intralaboratory searches, among the genetic profiles analysed in their laboratories, to detect eventual internal coincidences.

The second state level (Fig. 1) contains the State DNA Index System (SDIS) node, located inside the State Secretariat for Security, a place where interlaboratory searches are carried out of all genetic profiles sent by the different institutions, automatically reporting to the different laboratories involved in the genetic coincidences generated in the state node. These searches are permanently conducted 365 days per year.

This hierarchical system established in Spain has necessitated that the State Secretariat for Security create the Committee for Regulation and Coordination of the National Control System of Identifiers Obtained from DNA (COMSINGENI for its initials in Spanish). This Committee approves the framework document and a technical procedure manual, which includes all the established norms and files for storage of genetic profiles, and also the introduction, naming and comparison method requirements, for coordinated functioning and efficient development of searches in the CODIS software.

The DB establishes different types of searches, the design of which are based on several technical criteria that lead to optimising and searching for their maximum efficiency. On the one hand, they establish coincidences between profiles from questionable samples recovered from the crime scene

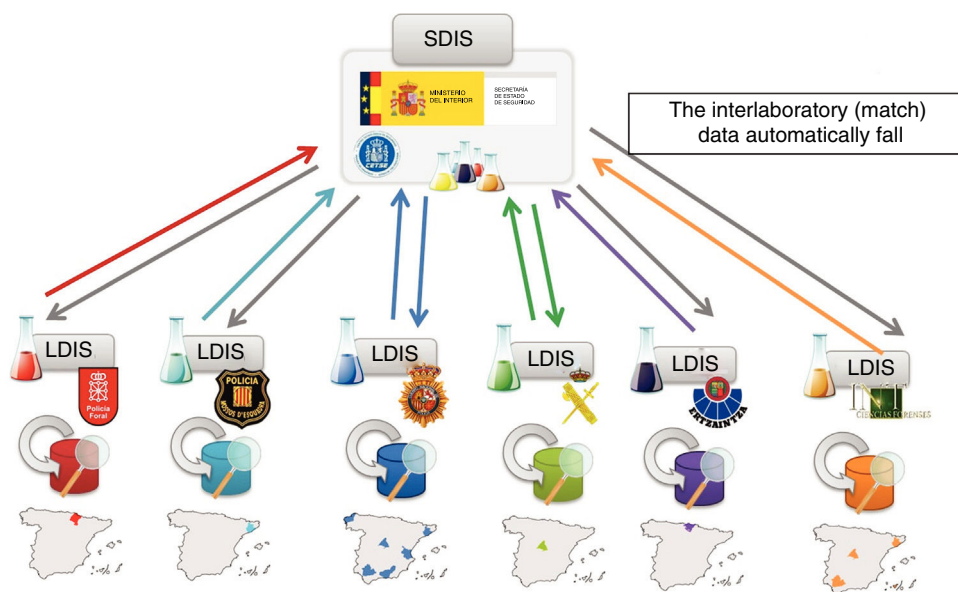


Figure 1 Hierarchy of the DNA database in Spain with the CODIS software.

or from the body of victims and unquestionable samples existing in the DB (suspects, screened individuals, convicts). The intention of this search is to match anonymous profiles to potential donors. In addition to this, the software is programmed to establish coincidences between questionable profiles, linking criminal acts over time and space. Lastly, in the area relating to the identification of cadavers, two types of searches are performed. The first searches for connections between existing cadaveric remains on the DB, to carry out a re-association of cadavers and secondly, kinship links are made between cadaveric remains and potential family members included in the DB. Of special relevance in the identification of cadavers and missing persons has been the recent development of the genealogy module in the CODIS system that enables searches to be made of cadavers compared with complex family groups, which has led to greater power of discrimination and has opened the doors to the analysis of a great number of kinship relations that would otherwise have been impossible to investigate.

Once the possible coincidence or compatibility of profiles by the DB has been reported, the specialists of different institutions involved should validate it, connect the information linked to the profile and if applicable, determine the statistical value of the compatibility/coincidence for its inclusion in the corresponding expert's report and subsequent communication to the appropriate judicial body.

According to the police database bank of identifiers obtained from DNA published with updated data until 2018,³ Spain currently has 371,054 unquestionable genetic profiles and 109,786 questionable genetic profiles, which includes a total of 2395 profiles from unidentified cadaveric remains. By type of crimes, 45% of the questionable profiles correspond to armed or violent robbery or robbery with intimidation,

followed by case of homicide (9.7%) and cases of aggressions or sexual abuses (8.5%). A total of 14,358 interlaboratory genetic coincidences have been reported which have led to the resolution of a large quantity of criminal acts, in addition to enabling identified corpses to be handed over to their respective families.

To conclude, we should state that the DNA police DB, the fruit of collaboration between 14 forensic laboratories from 6 public institutions is currently one of the most successful initiatives in the field of forensic genetics in Spain, acting as a tool for the criminal investigation and the identification of missing persons.

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