THE IMPACT OF CODIS SOFTWARE IN CRIMINAL INVESTIGATIONS IN THE ITALIAN NATIONAL POLICE

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The Italian legislators have not enacted yet a specific law which establishing a DNA database provides a set of rules for data collection and utilization. Therefore, at the present, each public or private Institution (e.g. National Police, Arma dei Carabinieri, University, etc.) has its own unofficial "DNA database" that are not connected among themselves. In some instances the prosecutor or the judge authorizes the different Institutions to exchange their respective data.

The Forensic Science Service of the Italian National Police, and in particular its DNA Investigations Unit, established its Combined DNA Index System (CODIS) program in January 1999 starting with the implementation of an STR population database (Figure 1).

By the end of June 2000 approximately one thousand individual STR profiles were collected using AmpF*l*STR™ Profiler™, Profiler™ Plus, SGM Plus™ and PowerPlex®16 commercial kits by Applied Biosystems and Promega. These data were included in the Population Database as well. Moreover, about one hundred STR DNA profiles were acquired and stored in the Convicted Offender Index and over 2000 STR DNA profiles in the Casework Index.

It is well known that CODIS enables the exchange and comparison of DNA profiles allowing the linking of the data related to serial violent crimes, like those of terrorism, kidnaps, rapes, armed robberies, burglaries, etc., either among themselves or to known suspects.

The following examples illustrate forensic casework where CODIS software was used successfully in criminal investigations. In particular, they demonstrate:

- how DNA profiles are to be as complete as possible and be based, at least, upon 13 STR loci (as CODIS core) to be considered sufficient evidence in trial (a lower number is useful only for exclusion);
- how DNA profiles can link several evidences to a particular offender;
- how statistical software can be successfully exploited during a trial to corroborate the DNA evidence.

Case 1: Triple homicide to Caserta (Organized Crime like Camorra).

In May 1995, during a firefight one offender and two other men were killed. At the crime scene bloodstains in the form of drops were found near the main door. The investigators, assumed that another offender had been slightly wounded during the shooting. DNA profiles were extracted from the crime scene's traces and from the victims. These traces were analyzed using AmpF*l*STR® Blue and Green I kits by Perkin Elmer (six loci plus amelogenin). All the derived profiles were found to be different.

The detectives suspecting that one of the offenders was a hit man of a particular Camorra's clan, obtained his DNA profile from the saliva found on cigarette stubs. This profile was compared with those related to the crime scene and was found a match with the bloodstain's DNA. This DNA profile in the Italian population data has a statistical frequency of 1 in 1.000.000. The Italian population amounts to 57.000.000 individuals of which 50% are males. This means that about 30 Italian males, statistically, had a compatible DNA profile.

In 1999, the same investigation, involved a second suspect who was the brother of the first suspect. The prosecutor following the comparison of the DNA profile related to the bloodstains and those related to the suspects 1 and 2 (brothers) has authorized a second DNA analysis to complete the DNA profile using AmpF*l*STR™ Profiler™ Plus. The DNA profiles thus obtained were compared with that of each suspect and the result was a match between suspect 2 (suspect's 1 brother) and the DNA profile of the bloodstains. It's interesting to note that the brother's DNA profiles were identical as for genotype on 8 STR loci. This information led the arrest of suspect 2, confirming his involvement in the triple homicide. His brother was acquitted.

Case 2: Elderly homicide in a burglary case.

In 1999, in different neighbors of Rome 31 burglaries occurred against elders, one of whom died immediately after the event. Some witnesses gave the investigators a detailed description of two young women assumed to be involved in these crimes. At the crime scene several cigarette stubs and other pieces of evidence were collected and analyzed. Two DNA profiles were obtained from the saliva using AmpF*l*STR™ Profiler™ and AmpF*l*STR™ SGM Plus™. The latters were compared with those of the two suspected women using buccal swabs. These DNA profiles were essential to prove their actual involvement in four of the 31 cases.

Case 3: DNA identification in Albania (Tirana – Immigration)

In May 2000, during an armed assault against a man who was driving a car, the intended victims, although wounded, was able to flee. The investigators, assuming that the man was an Albanian criminal involved in the smuggling of human beings from his country to Italy, asked the Unit to analyze the DNA profile obtained from the bloodstains found in the car and compare it with those of two individuals, supposed be relatives of the victim (son and wife). They were willing to give a sample of their saliva by buccal swab. The PCR was performed using AmpF*l*STR™ Profiler™ and SGM Plus™ (fifteen STR loci plus amelogenin). A comparison was made and, based upon genetic evidence, it was possible to ascertain that there was an actual relationship between the two individuals with the unidentified man since then by the software Popstat v.5.2.

Conclusion

In the first case, it was necessary to analyze up to 9 STR loci to discriminate two brothers. We believe it's essential to perform a correct sampling of the Italian population (at least 500 people, regional area, same origin area for parents and sons, at least 1 generation) and to use the product role to estimate the genotype frequency of a DNA profile (1).

In the second case, using CODIS, we were able to compare in a very short time, thousands of DNA profiles thus linking crimes occurring in different places to the same offender.

The third case proves that it is of paramount importance to use specific software to accomplish statistical inference of DNA analysis and gain the cooperation among the countries of the Mediterranean area such as Albania, Montenegro, etc. to fight illegal immigration, and a number of other serious crimes.

This report is a contribution of the Forensic Science Service of the Italian National Police aimed to expand the use of a software, like CODIS, in each Country to harmonize DNA data (like AFIS Automatic Fingerprint Identification System), to allow more users to expand their statistical knowledge, therefore improving the scientific tools against national and transnational crimes.

Reference

1) Biondo R, Spinella A, Montagna Paola, Walsh P.S., Holt C, Budowle B. Regional Italian allele frequencies at nine short tandem repeat loci. Forensic Sci. Int. (2000) in press.

Figure 1.