USE OF DNA TYPING FOR CRIMINAL CASEWORK IN SRI LANKA

Nalin C.W. Goonesekere, Ph.D., Maya B. Gunasekera, Ph.D., and Neil Fernandopulle, B.Sc.

Department of Chemistry, University of Colombo, Sri Lanka.

Sri Lanka is a small island of 17 million people, situated in the Indian Ocean. It is a member of the Commonwealth of Nations, and its system of justice has elements of both English Law as well as Roman Dutch Law. There has been no special legislation enacted specifically to deal with DNA evidence. Under the current laws of evidence, blood samples can be obtained from suspects for DNA typing, provided prior consent is obtained. However, it is possible to obtain a buccal swab, or hair samples, without consent from the suspects.

We began our work on DNA typing in Sri Lanka in 1996, due to the considerable public interest in this field. The reason for this is that apart from its relevance to routine criminal investigations, DNA typing can also be applied to identify victims in mass graves, and victims of bomb blasts. We selected the short tandem repeat (STR) method[1] of DNA typing, because it has the twin advantages of high sensitivity, and the easy assignment of alleles. Further, this method does not require the use of radioactive chemicals, and is also technically less demanding than methods based on minisatellites.

We began by establishing population databases for some selected STR markers through a research grant from the National Science Foundation of Sri Lanka. The STR markers we selected included the CTT system, the FFv system and the Silver STR system (Promega Corporation, U.S.A.). While we were engaged in our research project, a particularly gruesome mass murder took place in Sri Lanka shocking the entire nation.

On February 10, 1999, in the village of Hokandara in a suburb of Colombo, six members of one family comprising the father, mother, three daughters, and a son were brutally murdered. The perpetrators had used a variety of weapons including knives, iron bars, and an axe. One of the alleged murderers was also found dead at the scene of the crime. Based on previous records of a land dispute, three suspects were arrested the same day. All three suspects were found to be wearing blood stained clothing at the time of the arrest. These items were immediately removed and stored as evidence by the police. Several strands of hair were also recovered from one of the suspects. The police report also indicated that one of the victims may have been raped. However, no vaginal swabs had been taken. The case against the suspects was based entirely on circumstantial evidence as there were no eyewitnesses and no direct evidence for the presence of the suspects at the scene of crime.

It was under these circumstances that the police sought our assistance, through a court order, to DNA type the blood stains and the hair samples found on the suspects clothing, weapons and compare them to body swabs, blood stained clothing and hair samples of victims obtained during the autopsy. We received the samples exactly two weeks after the murder. During this time, the samples had been kept at room temperature (31^{o}C) under ambient humidity (80% relative humidity). In addition, we received blood samples from all three suspects, collected with their consent.

The evidentiary material was subjected to STR typing by multiplex PCR (GeneAmp 2400, Perkin Elmer, U.S.A.) at nine loci described above. Briefly, DNA from bloodstains were extracted using the chelex procedure[2] and PCR amplified[3], while the hair samples were boiled directly in the PCR buffer[4] before amplification. PCR products were analyzed by polyacrylamide gel electrophoresis and visualized by silver staining[5]. The DNA profiles obtained are given in Table 1.

Table 1: Case DNA profiles for Nine STR loci

STR LOCUS	CSF 1P0	TPOX	TH01	F13A 01	FES FPS	V W A	D16 S539	D7 S820	D13 S317
Victim 3 (dau) (hair)[1]				3.2,6	11,13	15,18			
Victim 4 (son) (clothing)	10,11	9,11	9,9.3	3.2,6	12,12	16,18	10,11	8,11	11,12
Victim 5 (dau) (clothing)[2]				3.2,6	10,12	16,18			
Victim 5 (dau) (hair)[1]				3.2,6	10,12	16,18			
Blood stain 1 (Clothing) (suspect 1)	10,11	9,11	9,9.3	3.2,6	12,12	16,18	10,11	8,11	11,12
Blood stain 2 (Clothing) (suspect 1)[3]	10,11	9,11	9,9.3	3.2,6	12,12	16,18			
Blood stain 1 (Clothing) (suspect 2)	10,11	9,11	9,9.3	3.2,6	12,12	16,18	10,11	8,11	11,12
Blood stain 1 (Clothing) (suspect 2)[3]	10,11	9,11	9,9.3	3.2,6	12,12	16,18			
Blood stain1 from Clothing (suspect 3)	10,11	9,11	9,9.3	3.2,6	12,12	16,18	10,11	8,11	11,12
Blood stain 2 (Clothing) (suspect 3)[3]	10,11	9,11	9,9.3	3.2,6	12,12	16,18			
Hair sample from Clothing (suspect 2)[2]				3.2,6	11,13	15,18			
Suspect 1[3] (blood sample)	11,11	8,8	6,7	5,7	11,12				
Suspect 2[3] (blood sample)	11,11	8,11	9,11	5,6	12,14				
Suspect 3[3] (blood sample)	11,12	11,11	9,9.3	5,7	11,12				

1. The entire hair sample was used for one multiplex (FFv) reaction.
2. CTT loci could not be typed; Silver STR loci were not subjected to typing.
3. Silver STR loci were not subjected to typing.

Discussion:

Bloodstains from the clothes of all three suspects were successfully typed at all nine loci, and all revealed an identical pattern, indicating that the blood was from one individual. An identical DNA profile was also observed for one of the victims (the son). Thus, the DNA evidence was supportive of the conclusion that the bloodstains found on the clothing of all three suspects came from one of the victims. When the single hair root, obtained from the clothes of one of the suspects was typed at the FFv locus, the DNA profile obtained was identical to the DNA profile of one of the victims (daughter).

Body swabs of victims taken at the autopsy by the Judicial Medical Officer (using gauze bandage material) did not yield successful PCR amplifications. The blood stains present on the clothes of the mother, and the daughters appeared to be “diffused” possibly indicating contact with water. These blood stains amplified poorly. There were no bloodstains present on the clothing of the father. The son’s garments, which contained most amount of blood, and had patches of well dried blood spots, amplified well. The suspects clothing contained small well dried patches of blood, mainly on the front side. All such stains that were subjected to PCR amplified well, and were readily typed. Due to financial constraints, all bloodstains were not subjected to DNA typing, and the Silver STR system was used only when deemed necessary. None of the bloodstains obtained from the weapons could be successfully typed at any of the loci. This is the first report on the use of DNA typing for forensic casework in Sri Lanka.

References:

1. Edwards, A., Civitello, A., Hammond H.A. & Caskey, C.T. (1991). DNA typing and genetic mapping with trimeric and tetrameric tandem repeats. *Am. J. Hum. Genet.* **49**, 746.

2. Walsh, P.S. & A. David. (1991). Chelex 100 as a medium for simple extraction of DNA for PCR-based typing from forensic material. *Biotechniques* **10** (4): 506-513.

3. *Promega Technical Manual* (1993) Part # TMD004, Promega Corporation, U.S.A.

4. Hartl, G.B., Kurt, F., Tiedemann, R. Gmeiner, C., Nadlinger, K., Khyne, U. & Rubel, A. (1996). Conservation genetics and systematics of Asian elephant (*Elephas maximus*): A study based on sequence variation at the Cyt *b* gene of PCR-amplified mitochondrial DNA from hair bulbs. *Z.Saugetierk*. 61:285-294.

5. *Promega Technical Manual* (1993) Part # TMD005, Promega Corporation, U.S.A.