Biochemistry & Analytical Biochemistry
ISSN: 2161-1009

Mishra et al., Biochem Anal Biochem 2015, 4:2
DOI: 10.4172/2161-1009.1000165

Research Article Open Access

# Application of DNA Fingerprinting in an Alleged Case of Paternity

**Amarnath Mishra[1*], Sathyan S[2] and Shukla SK[3]**

[1]Department of Forensic Science, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed University, Allahabad, India
[2]Department of Biology and DNA Fingerprinting Unit, Central Forensic Science Laboratory, Hyderabad, India
[3]AIFS, Amity University, Noida, UP

## Abstract

The forensic DNA analysis is commonly used to detect the criminal activities but, it is also used in civil cases to establish the paternity of disputed offspring. The majority of cases regarding disputed paternity arise in the context of affiliation orders, divorce proceedings and questioned legitimacy, may also be used to find out paternity in cases of inheritance, guardianship, maintenance, legitimacy, adultery or fornication. The present work is done to find out the biological father of child in a case where mother alleged to a person for her pregnancy.

**Keywords:** Forensic DNA analysis; Inheritance; Paternity; STR loci

## Introduction

DNA fingerprinting is proving to be of great importance in the establishment of the paternity of an individual. The forensic DNA analysis is commonly used to detect the criminal activities such as homicide, rape but, it is also used in cases to establish the paternity of disputed offspring or, to know the identity of dead person and cases of baby swapping [1,2].

DNA Typing can be used to test any DNA containing biological trace evidence. The composition of the DNA molecule essentially does not vary from cell to cell; therefore, the DNA in blood is identical to that in other biological material such as hair, semen, skin, and bone marrow [3].

In India, DNA fingerprinting has been added to the routine work of disputed paternity cases as a powerful tool of investigation in Forensic cases. The old conventional investigation based on blood antigen systems like variable blood groups, HLA Tissue Typing was no more used in such sensitive cases because of the limitation or invariability of loci analyzed [4].

Paternity, the state of being a father, can be legally established in several ways. When the parents of a child are married, paternity is commonly presumed. To determine whether a man is the father of a child born out of wedlock, a lawsuit known as a "paternity action" must be brought. In such a suit, paternity may be established if the alleged father admits paternity [5,6].

Blood-group studies, which commonly employ the ABO system, cannot establish paternity but can conclusively exclude an alleged father from being a candidate. This is the case because a child must inherit his or her blood type from the mother and/or father; thus, if the child's blood type differs from both the mother's and the alleged father's types, the man could not possibly be a parent of son. A typical population frequency for conventional blood typing might be 1 in 200, for DNA 1 in 5,000,000. This means that only 1 in 5,000,000 people would have the same DNA profile.

Adequate samples for DNA typing can be collected from blood, blood stain and oral swab easily. DNA typing compares strands of genetic material between the child and alleged father comparing strands from various locations of the genetic material allows accuracy ratings of 99.9 percent [7]. DNA typing allows an alleged father to be excluded with 100 percent certainty [8]. The aim of present work is to perform an analysis of evidence to assist the court in establishing physical facts of criminal and civil disputes.

## Materials and Methods

The study was conducted at Central Forensic Science Laboratory, Hyderabad, India after ethical approval from Director, CFSL, Hyderabad. Samples were collected from Department of Biology and DNA Fingerprinting Unit, Central Forensic Science Laboratory, Hyderabad through legal proceedings.

**Case:** A lady was raped and gave birth to a baby. Now she files a case against a person for the cause of her pregnancy. So, DNA fingerprinting is done to assure that the blamed person is the biological father of the child. Two milliliter blood from the alleged father, mother and child were collected and stored for further analysis to carry out DNA fingerprinting.

**Samples obtained:** Blood sample of child: Exhibit A, blood sample of person: Exhibit B and blood sample of mother: Exhibit C.

DNA was extracted using organic extraction method, Isolation

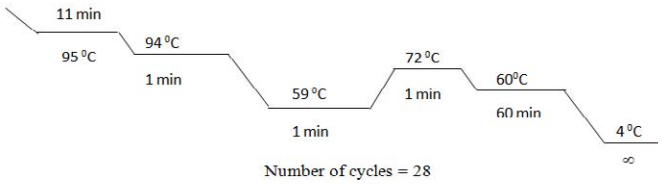


**Figure 1:** The PCR process consisted of three major steps Denaturation, Annealing and Extension. This process was repeated 20 to 30 times starting with a single copy of a specific nucleotide sequences. After amplification, the amplified products were separated and detected using ABI PRISM™ 3130 Genetic analyzer (Applied Biosystem) which based on STRs (short tandem repeats) was done with following materials: Hi-di formamide 24.5 µl, 500 Liz 0.5 µl and sample 1.5 µl.

***Corresponding authors:** Amarnath Mishra, Department of Forensic Science, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed University, Allahabad, India, Tel: +919454977836; E-mail: anmishra4u@gmail.com

**Received:** January 09, 2015; **Accepted:** February 16, 2015; **Published** February 24, 2015

**Citation:** Mishra A, Sathyan S, Shukla SK (2015) Application of DNA Fingerprinting in an Alleged Case of Paternity. Biochem Anal Biochem 4: 165. doi:10.4172/2161-1009.1000165

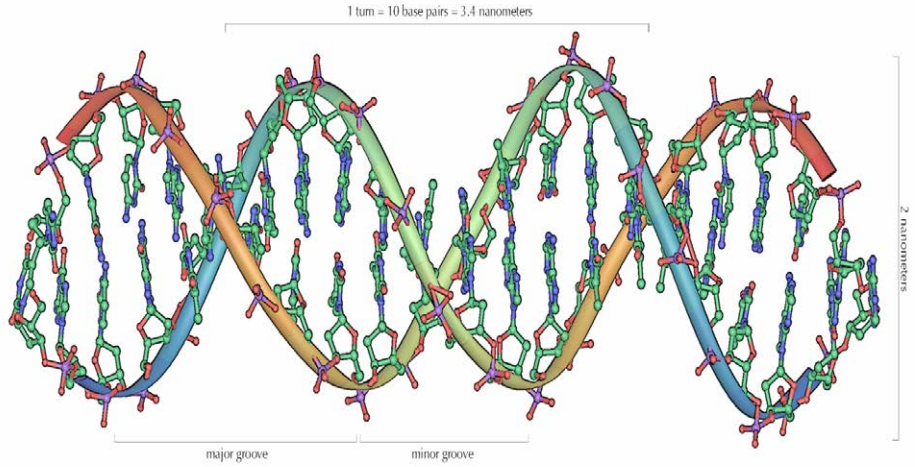


**Figure 2:** Double helix structure of DNA.

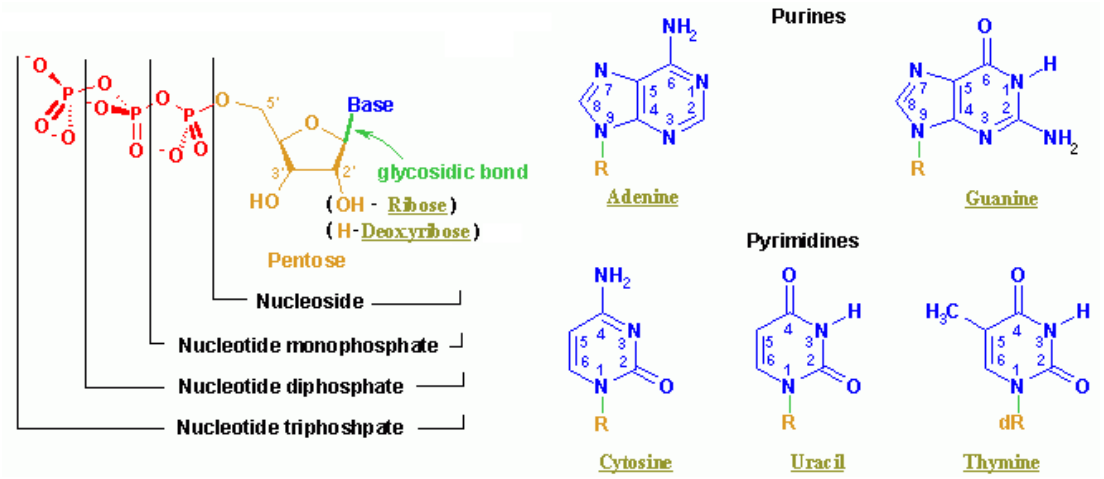


**Figure 3:** Chemical composition of DNA.

| Locus/marker | Baby (Exh.-A) | Alleged person (Exh.-B) | Mother (Exh.-C) |
|---|---|---|---|
| D8S1179 | 14, 15 | 13, 15 | 12, 14 |
| D21S11 | 29, 32.2 | 30, 32.2 | 29, 31.2 |
| D7S820 | 11, 12 | 9, 12 | 11, 12 |
| CSF1P0 | 11 | 11, 12 | 11 |
| D3S1358 | 16, 17 | 15, 17 | 16 |
| THO1 | 7, 8 | 7, 9 | 8, 9.3 |
| D13S317 | 9, 13 | 9, 11 | 9, 9 |
| D165539 | 10, 11 | 9, 10 | 9, 11 |
| D2S1338 | 19, 24 | 18, 20 | 18, 24 |
| D19S433 | 14, 14.2 | 13, 14 | 13, 14.2 |
| vWA | 17 | 14, 19 | 17 |
| TPOX | 8, 11 | 8 | 10, 11 |
| D18S51 | 13, 14 | 15, 16 | 14, 17 |
| Amelogenin | X, X | X, Y | X, X |
| D5S818 | 9, 11 | 10, 13 | 11 |
| FGA | 22.2, 23.2 | 23, 24 | 23, 23.2 |

**Table 1:** The results of autosomal genetic markers of CODIS for the trios on the bases of DNA profile (Figure 4a-4d).

of good quality DNA is a primary step in DNA finger printing which was done by organic extraction method. For organic extraction: stain extraction buffer, protinase K, phenol/chloroform/isoamyl alcohol1X SSC, 0.2M sodium acetate, 10% SDS, absolute alcohol (cold), TE (Tris EDTA), 2M sodium acetate were used. For check the quantity of DNA by quantification by 1% agarose gel electrophoresis following materials were used: gel, 1X TAE buffer, 1% agarose, ethidium bromide and bromophenol blue. Then, amplification of DNA samples were performed with AmpFLSTR® Identifiler™ kit by using PCR machine to increase the quantity of the DNA [9] following PCR reaction mixture were used for identifier: PCR reaction mix 10.5 µl, Taq polymerase 0.5 µl, primer 5.5 µl and DNA sample 10 µl (Figure 1).

## Discussion

DNA was extracted using organic extraction method (Figures 2 and 3) [10]. The amplified products were separated and detected using Genetic analyzer [11]. Simultaneous amplification of 16 STR loci (D8S1179, D21S11, D7S820, CSF1PO, D3S1358, THO1, D13S317, D16S539, D2S1338, D19S433, VWA, TPOX, D18S51, D5S818, FGA and AMELOGININ) was completed and analyzed [12,13].

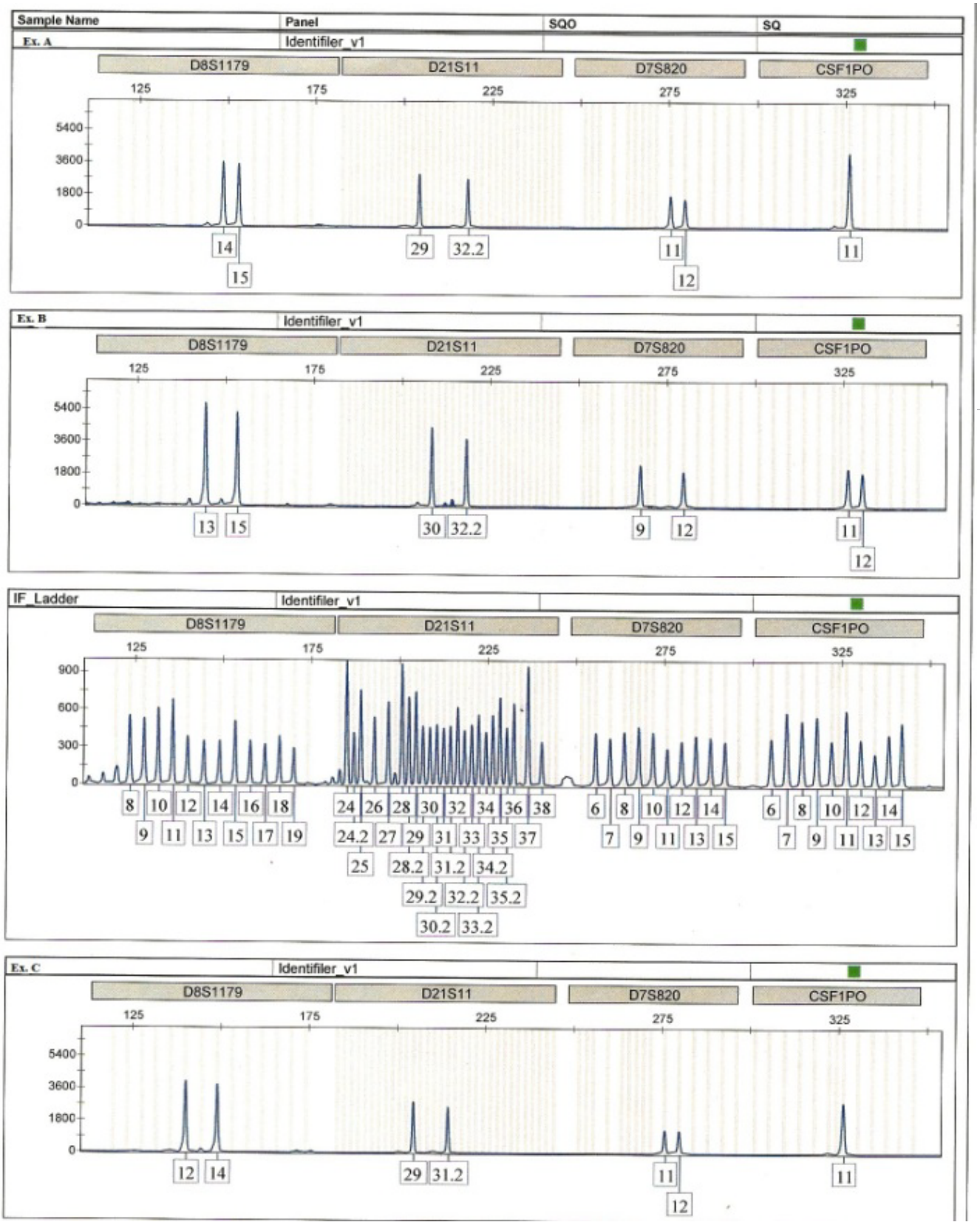


**Figure 4a:** Allelic distribution of disputed paternity case (STR loci: D8S1179, D21S11, D7S820 and CSF1PO).

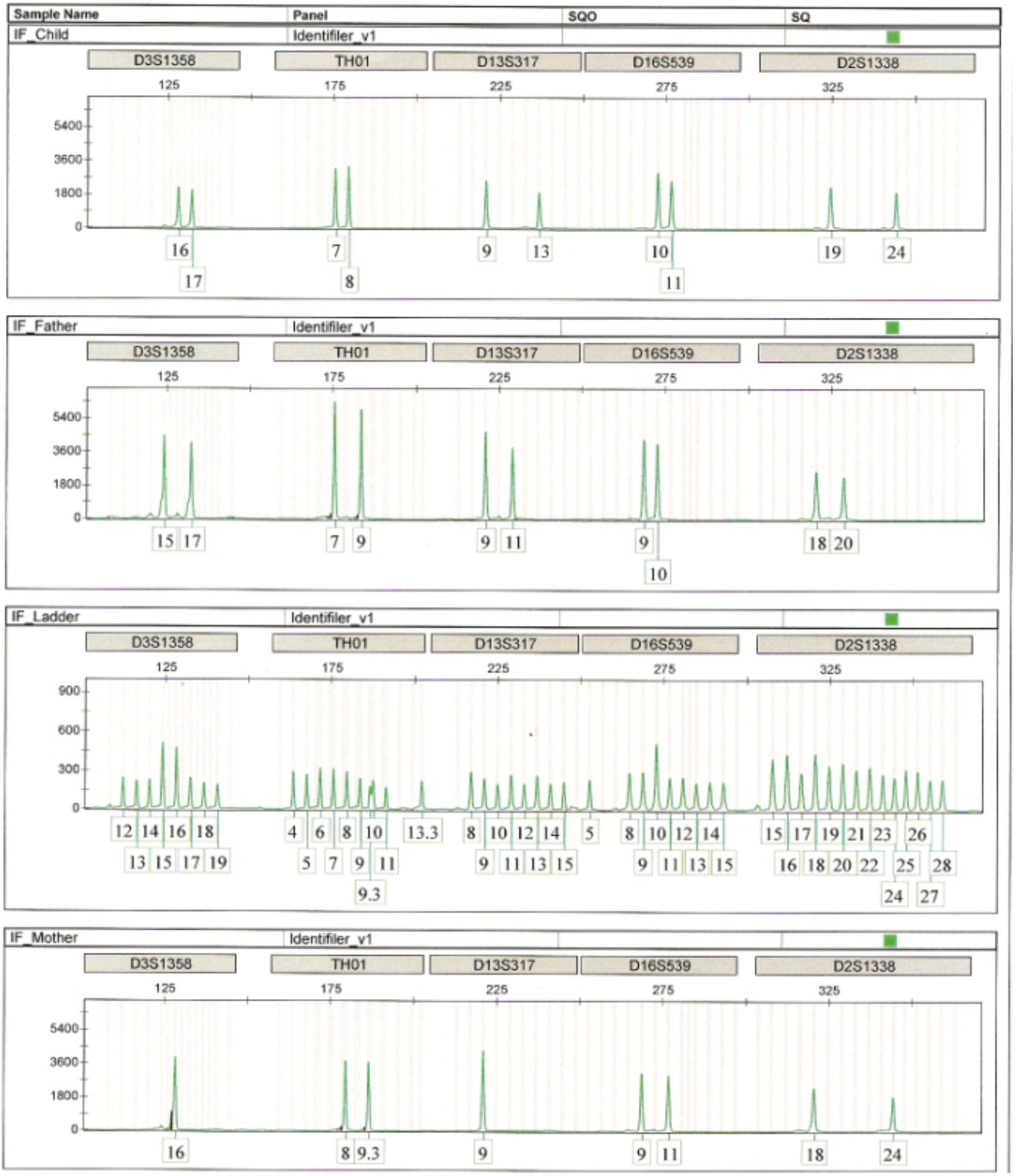


**Figure 4b:** Allelic distribution of disputed paternity case (STR loci: D3S1358, THO1, D13S317, D16S539 and D2S1338).

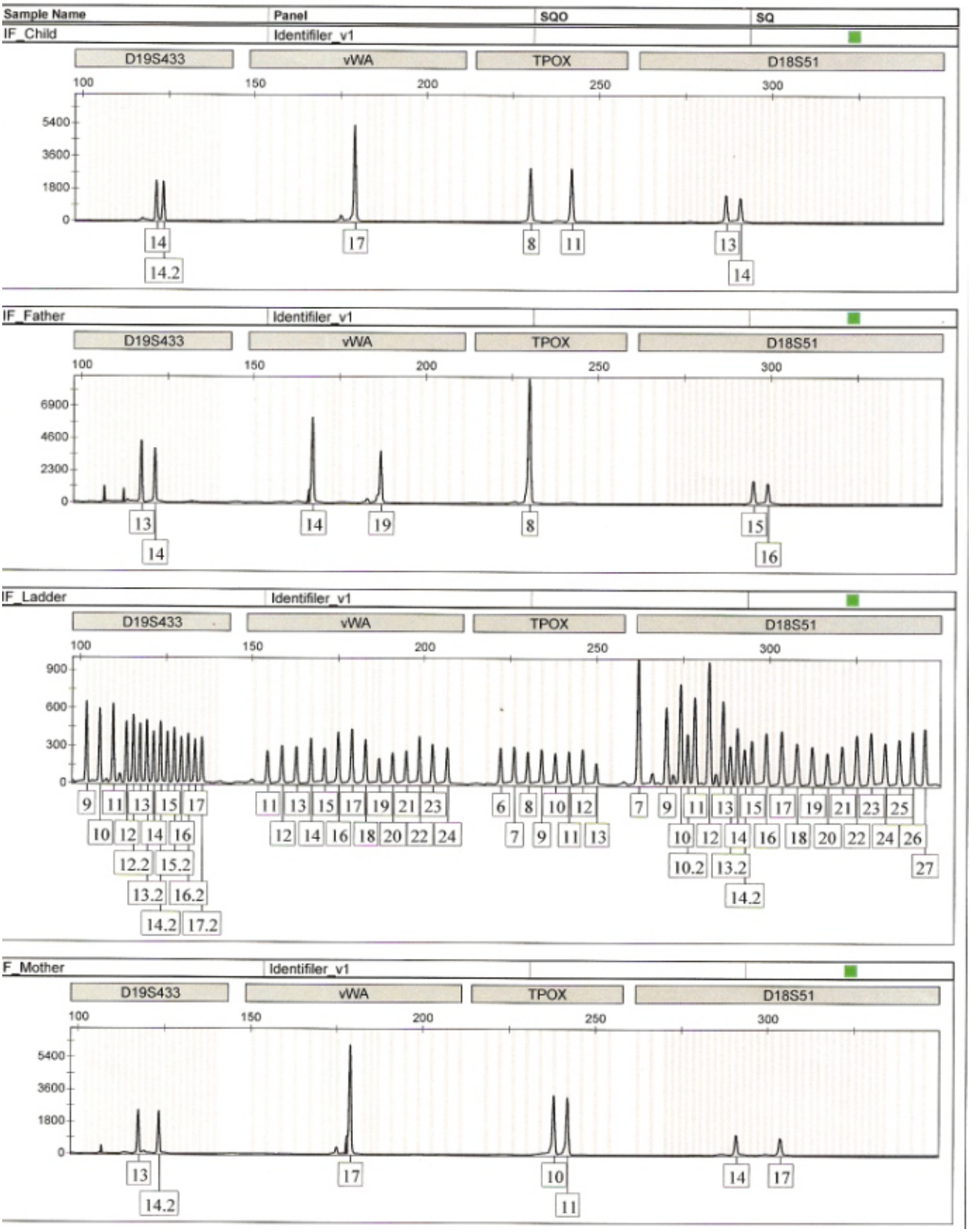


**Figure 4c:** Allelic distribution of disputed paternity case (STR loci: D19S433, VWA, TPOX and D18S51).

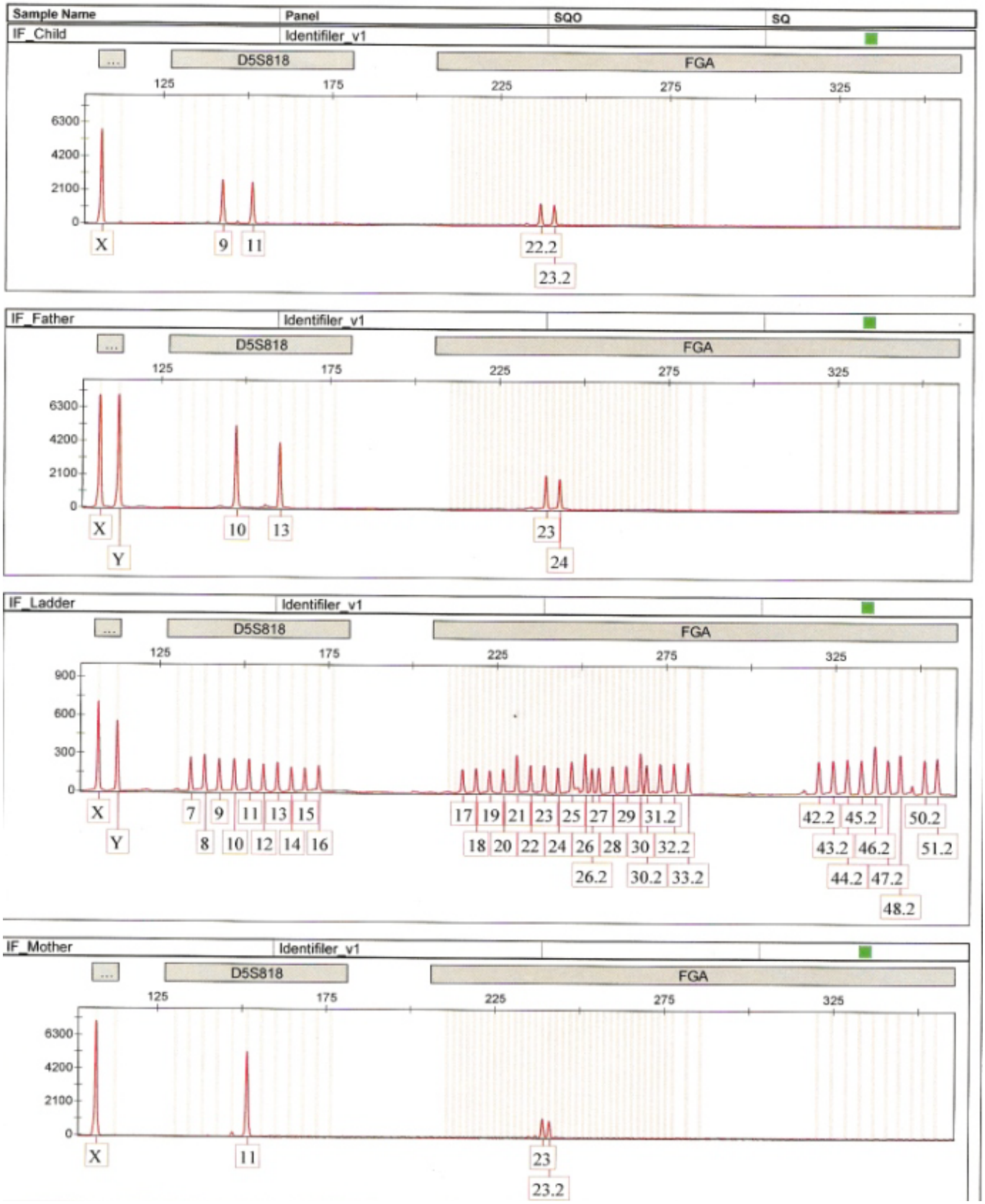


**Figure 4d:** Allelic distribution of disputed paternity case (STR loci: D5S818, FGA and AMELOGENIN.

Liquid blood sample 'C' of mother has one of the alleles in the genotype profile, of the amplified identifiler STR loci, alike to one of the alleles in the genotype profile of the liquid blood sample of baby 'A'. All the non-maternal alleles of the amplified identifier STR loci of the liquid blood sample of suspected father 'B' are different at D13S317, D2S1338, vWA, D18S51, D5S818 and FGA in the genotype profile of the liquid blood sample of baby exhibit number 'A' (Figure 4a-4d) [14,15].

On the basis of above observation it can be concluded that lady (victim) is the biological mother of baby whereas the suspected person is not the biological father of the baby (Table 1).

## Conclusion

DNA Profiling has revolutionized forensic genetics and is widely accepted in medico-legal cases. DNA analysis provides the best avenue for unequivocal exclusion of the innocent suspects. Due to all these impressive applications, DNA test has become the darling of the criminal and civil justice system world over.

### References

1. Jeffreys AJ, Wilson V, Thein SL (1985) Hypervariable 'minisatellite' regions in human DNA. Nature 314: 67-73.
2. Jeffreys AJ, Wilson V, Thein SL (1985) Individual-specific 'fingerprints' of human DNA. Nature 316: 76-79.
3. Watson JD, Crick FH (1953) The structure of DNA. Cold Spring Harb Symp Quant Biol 18: 123-131.
4. van Oorschot RA, Jones MK (1997) DNA fingerprints from fingerprints. Nature 387: 767.
5. Gunn PR, Trueman K, Stapleton P, Klarkowski DB (1997) DNA analysis in disputed parentage: the occurrence of two apparently false exclusions of paternity, both at short tandem repeat (STR) loci, in the one child. Electrophoresis 18: 1650-1652.
6. Henke J, Henke L (1999) Mutation rate in human microsatellites. Am J Hum Genet 64: 1473-1474.
7. Lygo JE, Johnson PE, Holdaway DJ, Woodroffe S, Whitaker JP, et al. (1994) The validation of short tandem repeat (STR) loci for use in forensic casework. Int J Legal Med 107: 77-89.
8. Butler JM, Shen Y, Mccord BR (2001) Forensic DNA typing: biology and technology behind STR markers. London: Academic Press.
9. Mullis K, Faloona F, Scharf S, Saiki R, Horn G, et al. (1986) Specific enzymatic amplification of DNA in vitro: the polymerase chain reaction. Cold Spring Harb Symp Quant Biol 51 Pt 1: 263-273.
10. Allen RC, Graves G, Budowle B (1989) Polymerase chain reaction amplification products separated on rehydratable polyacrylamide gels and stained with silver. Biotechniques 7: 736-744.
11. Reynolds R, Sensabaugh G, Blake E (1991) Analysis of genetic markers in forensic DNA samples using the polymerase chain reaction. Anal Chem 63: 2-15.
12. Budowle B, Allen RC (1998) Analysis of amplified fragment-length polymorphisms (VNTR/STR loci) for human identity testing. Methods Mol Biol 98: 155-171.
13. Gill P, Kimpton CP, Urquhart A, Oldroyd N, Millican ES, et al. (1995) Automated short tandem repeat (STR) analysis in forensic casework--a strategy for the future. Electrophoresis 16: 1543-1552.
14. Lincoln PJ, Thomson JR (1998) Forensic DNA profiling protocols. Human Press, Totowa, NJ. USA
15. Primorac D, Schanfield MS (2000) Application of forensic DNA testing in the legal system. Croat Med J 41: 32-46.