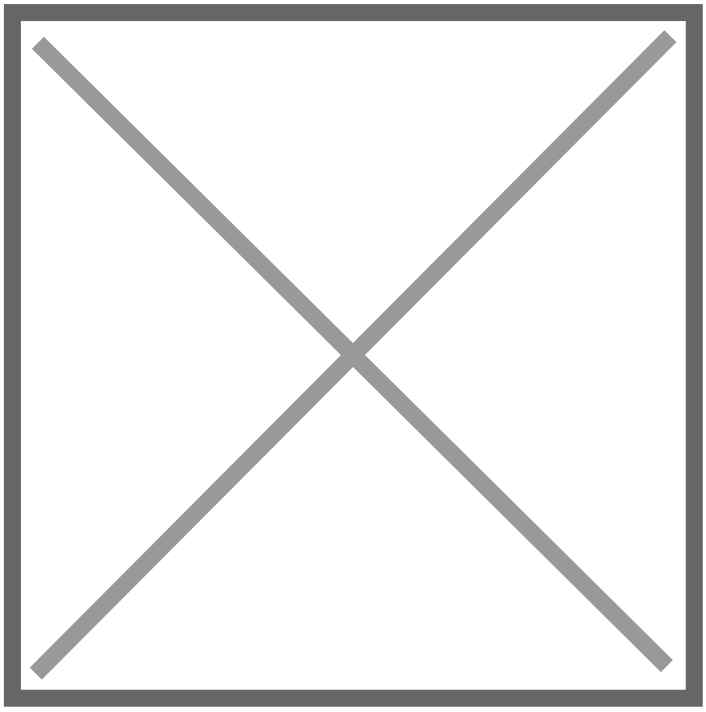
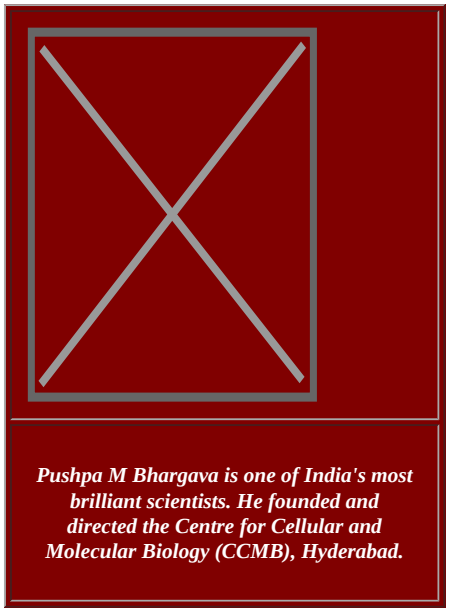
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Need for a commercial DNA fingerprinting unit

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Need for a commercial DNA fingerprinting unit



Pushpa M Bhargava is one of India's most brilliant scientists. He founded and directed the Centre for Cellular and Molecular Biology (CCMB), Hyderabad.

The number of times the DNA fingerprinting technique has been used is excruciatingly small when compared to the extent to which it could have been used mainly because there are no reliable and trustworthy commercial DNA fingerprinting laboratories in the private sector.

When 3200 years ago, the legendry Solomon, King of the Hebrews, was petitioned by two women, both of whom claimed to be the mother of the same child, he decided the case by playing upon the genuine emotions of the true mother who would rather give the child to the other woman than have it cut into two pieces. Today, the wise Solomon would have asked to have the issue settled irrevocably by having the two women and the child DNA fingerprinted.

Closer to our time, in 1909, Prince Ramendra Narayan Roy of Bhawal Raj, a princely estate in the eastern district of Dacca in the British Bengal, was suddenly declared dead in Darjeeling under mysterious circumstances. A couple of decades later, an unknown Sanyasi arrived in Dacca who claimed to be Ramendra Narayan Roy and was identified to be him by the people of

the estate and members of his family except his wife. There was a hard-fought legal battle at several levels, with the case even going to the Privy Council in London. The judgment was in favor of the 'Bhawal Sanyasi'. Today, with the availability of the DNA fingerprinting technology in the country, the case would have been settled within a week and without much expense.

In the 1940s, when I was a student of Lucknow University, the country was rocked by the disappearance of a young pretty maid Bilasia, apparently at the hands of one BB Singh, ICS. Sometime later, a few bones were unearthed from a site where a part of the dismembered body of the Bilasia was supposed to have been buried. The question that then became paramount in the eyes of both the law and the public was: did the bones belong to Bilasia? This would have been a non-question today. It would have been easily resolved by DNA fingerprinting the bones and Bilasia's parents.

These are just three cases from history. Today, in our country alone, there could be easily a couple of hundred thousand cases of murder or disputed parentage, which could be settled irrevocably by using the technology of DNA fingerprinting. In fact, hundreds of such cases, if not thousands, have already been settled in this way by using the DNA fingerprinting technology pioneered in the country by Lalji Singh, currently Director of Centre for Cellular and Molecular Biology at Hyderabad, beginning 1988 Ã¢â?¬â?? i.e., three years after the technology was first developed and used by Alec Jeffreys in the UK. DNA fingerprinting has been, in the last few years, also used to a very limited extent by the Centre for DNA Fingerprinting and Diagnostics (CDFD) at Hyderabad (an offshoot of the CCMB) and by a few forensic laboratories in the country where the staff has been, virtually in all cases, trained in the CCMB under the overall supervision of Lalji Singh. Yet it is disappointing that the number of times this technique has been used is excruciatingly small when compared to the extent to which it could have been used. The reason for this extremely limited usage of one of the most powerful technologies of today has been that there are no reliable and trustworthy commercial DNA fingerprinting laboratories in the private sector.

Before I argue the case for setting up an efficient and reliable DNA fingerprinting facility in the private sector on a commercial basis, in some detail, I would briefly describe the principle of DNA fingerprinting.

That DNA is the genetic material is now common knowledge. The DNA of all the cells of the body of any individual is exactly the same in terms of the sequence of its building blocks. Similarly, DNA of identical twins is also exactly the same. There are regions in DNA, that is, structure in this linear sequence of its building blocks Ã¢â?¬â?? which vary from individual to individual to an extent that the exact sequence is not the same in any two individuals. The possibility of any two individuals having the same set of variations in a number of such selected regions of DNA, turns out to be, for all functional purposes, zero.

Therefore, if we could identify these regions and find a probe that would locate one (a single locus probe) or more (a multi-locus probe) of such regions and visualize the regions thus located in a way that individual differences become manifest, we would obtain a kind of genetic fingerprint of the individual that would identify him irrevocably as it would be unique to the individual. The same would be true of animals and plants. Only identical twins or plants propagated vegetatively would have identical genetic fingerprints.

In fact, the DNA fingerprints have lines or bands as in a bar code, 50 percent of the lines or bands coming from one parent and the other 50 percent from the other parent in the case of animals. Therefore, all that would have needed to be done in the case of Solomon was to determine which of the two women's DNA had 50 percent of the bands of the disputed child's DNA.

In addition to establishing paternity or maternity or the identity of an individual (as was required in the case of Bilasia), or the genetic disorder(s) an individual may suffer from, the DNA fingerprinting technology can be used in many other ways mentioned below.

(a) In solving rape cases - A few hair roots, or a small sample of blood, buccal smear, semen spots or skin tissue left behind by the criminal, is sufficient to obtain a DNA fingerprint which can be compared to that of the suspect for confirming the rape charge beyond any doubt. Vaginal swabs taken up to 20 hours after intercourse are particularly suited for identification of the rapist.

(b) In solving murder cases

(c) In identification of mutilated bodies and skeletal remnants

(d) In establishing family relationship for immigration

(e) In solving cases of allegations of "switched babies"

(f) In establishing identity of missing children

(g) In social security record identification

(h) In solving ransom cases - In one case the suspected criminal was identified unequivocally by DNA fingerprinting the saliva he used to stick the stamp on the envelope containing the letter asking for the ransom!

(i) For defense records - DNA profile of service personnel can be of immense help in establishing their identity during disasters such as a crash, or during war. DNA analysis of applicants at the time of recruitment may help in detection of a number of genetic diseases, which may incapacitate a person during critical hours of military operation.

(j) Pedigree assurance in livestock breeding, and cell line authentication in researcher for industry

(k) Agriculture, horticulture and veterinary practice - For example, for proper identification of seeds, identification of markers and the mapping of genes affecting economically important traits such as meat and milk production or disease resistance.

The urgent need in the country today of a facility for identification of agricultural material, such as seeds or plants, alone would ensure profitability of a DNA fingerprinting project in the private sector, especially if the organization set up for DNA fingerprinting also carries out DNA-based diagnosis of inherited disorders, using essentially the same infrastructure as is required for DNA fingerprinting. In our estimate just by doing 50,000 agricultural samples, 10,000 cases of disputed parentage, 30,000 samples for establishing individual identity, and 30,000 samples for diagnosis of genetic diseases, one can have, at today's prices, a net profit of over 50 crore per year at the end of 10 years. The initial investment (including working capital) will be less than Rs 20 crore, and the project will start yielding revenue from the second year, with all the investment recovered by the end of four years. (We have a detailed project report available in support of what I have just said.)

I hope very much that not before long an appropriate DNA fingerprinting facility, which would also engage in DNA-based diagnosis of inherited disorders will become available in the private sector.

Pushpa M Bhargava