Chapter-VII

Conclusion

1. Introduction

1.1 DNA Databank: An Over View

DNA Data Banking is a need of the time. Every country must take a step ahead to establish DNA Data bank in their respective jurisdiction where no such establishment has yet been introduced.

While dealing with DNA Data Bank establishment one should take into consideration the following aspects[312]:

- What is DNA data banking?
- What should be the Object-purpose of creating DNA data banking?
- Useful to whom and how
- What type of data is preserved?
- What should be there in DNA data base?
- What is the condition in foreign countries
- DNA data banking and India. Why is there a need of creating DNA data bank in India?
- Functioning of DNA data banking.
- Why is there a need of legislation?
- How should it be prepared?

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[312] See, Allison Puri and Mike Redmayne, "An International DNA Database: Balancing Hope, Privacy and Scientific Error", "DNA evidence probability and the courts"1995 *criminal law review* available athttp://www.met.police.uk/history/fingerprints.htm,http://www.pbs.org./wnet/redgold/innovators/bio_landsteiner. (accessed on 26th july 2009)
See also-Gill.peter.Alec J.Jeffery And David J. werret *"Forensic application of DN fingerprinting"*, Available at http:/www.pbs.org./wgbh/pages/frontlineshows/case/revolution /wars.html. and http://web.utk.edu/ and (accessed on 26th July 2009) and http://www.mslawyer.com. (accessed on 26th July 2009)
-See also Pandit M., W. AND Dr. Lalji Singh 'DNA testing, Evidence Act and Witness testing' *The Indian Police Journal* dec-2000 p.100 (Cr.L.J. 2004) H.C Articles Available at MANU/tn/2335/2002.

- Who are the persons authorized to maintain data bank, to regularize functions of DNA data bank
- DNA data and privacy issue.
- Creation of DNA advisory board by legislatures.
- Standard created by DNA advisory board should be made responsible for declaring national standard of forensic DNA analysis.
- What should be the functions of DNA data banking in India
- Laboratory, organization-personal qualification, documentation, materials and equipments, validation of analytical procedure.
- Creation of CODIS[313].
- Laboratories have to prepare their special DNA analysis program according to the need of the country.
- Case study, research-development-technology, data preparation and maintenance, computerizing DNA index system.
- How the DNA data base should be prepared?(at District, State, National level)
- In case of need of DNA evidence role of judge, police officer, lab system, the investigation agencies
- Considering australian law while DNA index, crimes act....other foreign laws while establishing DNA Data bank.
- Utility, advantages and disadvantages, limitations of DNA index, profiling, data banking should also be considered.
- rules applicable for all

1.2 Forensic Laboratories

The crime lab systems in operation across the country vary in structure. Public crime labs may be Federal-, State-, county-, or city-sponsored. Many public labs are

[313] The development and expansion of databases that contain DNA profiles at the local, State, and national levels have greatly enhanced law enforcement's ability to solve cases with DNA. Convicted offender databases store hundreds of thousands of potential suspect DNA profiles, against which DNA profiles developed from crime scene evidence can be compared. Given the recidivistic nature of many crimes likelihood exists that the individual who committed the crime being investigated was convicted of a similar crime and already has his or her DNA profile in a DNA database that can be searched by the Combined DNA Index System (CODIS) software. Moreover, CODIS also permits the cross-comparison of DNA profiles developed from biological evidence found at crime scenes. Even if a perpetrator is not identified through the database, crimes may be linked to each other, thereby aiding an investigation, which may eventually lead to the identification of a suspect.

associated with a law enforcement entity; some are associated with a district attorney's office, while others are independent government entities. Some forensic laboratories are privately held companies.

Not all laboratories are capable of providing comprehensive and complete forensic services. Some do not have the capability to conduct DNA testing and may need to contract out their DNA cases to other agencies or private corporations.

Not all laboratories are capable of the same DNA testing either. Most DNA labs have the capability to conduct testing on nuclear DNA, which is the single copy of DNA that exists in every cell nucleus. A select few specialize in Y-STR testing, which is DNA conducted on the Y-chromosome, which is found only in males.

Others specialize in testing mitochondrial DNA (or mtDNA), which is found in every cell of the body regardless of the presence of a nucleus[314].

- Criteria for entry of DNA profiles into databank vary from country to country e.g., Belgium has no Suspects' database, Austria limits it only for suspects of "serious offences", UK has it for all suspects
- Likewise, criteria for removal of DNA profiles from databank also vary e.g., in time of retention for convicted offenders as well as for suspects; in the UK, the law allows for indefinite retention of suspects' profiles even if the suspect is released or acquitted
- DNA databank shall have following indices for various categories of data (DNA identification records):

- A crime-scene index;
- A suspects' index;
- An offender's index;
- A missing persons' index;
- An unknown deceased persons' index; and
- A volunteers' index

[314]See,Article, "Advancing Justice Through DNA Technology",Available at http://www.dna.gov/basics/laboratory/ (accessed on 7th august 2009)

- No person who receives the DNA profile for entry in the DNA data bank shall use it or allow it to be used for purposes other than for the administration of this Act.
- Criteria specified for removal of information (e.g., when a conviction has been set aside on appeal) or retention of DNA Profiles
- Post-conviction DNA testing for establishment of innocence

1.3 DNA Profiling Board

- Offer advice on the size, location, creation/ up gradation of DNA Laboratories
- Monitor, conduct, and audit training programmes and be responsible for quality control and assessment of DNA laboratories
- Supervise and inspect the equipment and material facilities
- Authorize communication of DNA profiles to National law enforcement agencies and for crime investigation
- Make recommendations for maximizing the use of DNA techniques and technologies
- Identify potential scientific advances that may assist law enforcement agencies in using DNA techniques
- Ethical, Legal, and Social Concerns about DNA Databanking must be considered while making legislations on DNA
- DNA patterns may not be neutral
- Fairness in the use of genetic information in the database by insurers, employers, courts, schools, adoption agencies, and the military, among others. Who should have access to personal genetic information, and how will it be used?
- Privacy and confidentiality of genetic information who owns and controls genetic information?
- Psychological impact and stigmatization due to an individual's genetic differences
- How does personal genetic information affect an individual and society's perceptions of that individual?
- How does genomic information affect members of minority communities?

1.4 Use of DNA Data Base:

DNA Data Base is used in other foreign countries to enhance the ability of law enforcement agencies by using local state and national DNA Database.

Databases contain thousands of DNA profiles which can be matched by evidentiary items collected from places of occurrence. Convicted offender database is used to solve crimes like burglary, murder. Sexual offences. Deterrent for criminals who intend to repeat crimes.i.e. They can be apprehended at any time[315].

Filing the information: DNA profile database

- CODIS Combined DNA Index System[316]
  - run by FBI
  - contains profiles of convicted offenders
  - contains unidentified DNA taken from crime scenes
  - CODIS allows identifying possible suspects when no prior suspect exists

DNA profile databases: Invasion of privacy

- Some groups are worried that DNA samples will get in hands of insurance companies or potential employers use to identify genetic defects that might cost them $$
- Is this concern invalid?
- DNA profiles are different from fingerprints, which are useful only for identification. DNA can provide insights into many intimate aspects of a person and their families including susceptibility to particular diseases, legitimacy of birth, and perhaps predispositions to certain behaviors and sexual orientation.
- Some groups are demanding that DNA samples be destroyed after investigation is complete. Stored DNA contains much more information than

[315] See, Article on DNA Data Base ,Available at http://www.legislation.gov.uk/ukpga/2003/42/contents and http://www.cps.gov.uk/news/fact_sheets/sexual_offences/ (accessed on 1oth August 2009)

[316] visit CODIS website to see how it works -www.fbi.gov/hq/lab/codis/index1.htm (accessed on 3rdApril 2009)

simple physical features, and thus provides much more raw material for information.

- Who is chosen for sampling is a concern.
- Suspects can be forced to provide a DNA sample. Arrestees --regardless of the degree of the charge and the possibility that they may not be convicted--can be compelled to comply. This empowers police officers to 'investigative arrests'.
- Would it be against human rights? Practicality also is a concern.
- An enormous backlog of over half a million DNA samples waits to be entered into the CODIS system. The statute of limitations has expired in many cases where the evidence would have been useful for conviction

Multiple roles of Police: Coercion and tutored reporting

Public Policy Issues

- Who should & shouldn't be in the DNA Database?
- Who should have access to the DNA Database?
- How can the information in the DNA Database be used?
- How long is a DNA sample retained?
- Should 'Right to Information' be more secured and restricted for DNA based information
- Legislative Responsibilities
- To make proper panel and advisory body for maintaining uniformity on DNA identification records, storage and DNA analyses
- Federal funding for DNA Databanks
- Relevant federal acts to safeguard public interest
- Forensic DNA Databanks and Privacy of Information:

DNA typing in the criminal-justice system has so far been used primarily for direct comparison of DNA profiles of evidence samples with profiles of samples from known suspects. However, that application constitutes only the tip of the iceberg of potential law-enforcement applications. If DNA profiles of samples from a population were stored in computer databanks (databases), DNA typing could be applied in

crimes without suspects. Investigators could compare DNA profiles of biological evidence samples with a databank to search for suspects.

In many respects, the situation is analogous to that of latent fingerprints. Originally, latent fingerprints were used for comparing crime-scene evidence with known suspects. With the development of the Automated Fingerprint Identification Systems (AFIS) in the last decade, the investigative use of fingerprints has dramatically expanded. Forensic scientists can enter an unidentified latent-fingerprint pattern into the system and within minutes compare it with millions of people's patterns contained in a computer file. In its short history, automated fingerprint analysis has been credited with solving tens of thousands of crimes.

This examines whether similar databanks of DNA profiles should be created and, if so, how and when.

1.5 Comparison of DNA Profiles and Latent Fingerprints

To identify key issues pertinent to the establishment of DNA databanks, it is instructive to compare DNA profiles and latent fingerprints.

- Latent fingerprints are found at crime scenes much more commonly than are body fluids that contain DNA. Latent-fingerprint analysis can be useful in a wide range of crimes, including many murders, rapes, assaults, robberies, and burglaries. However, the probative value of latent fingerprints is often limited to establishing that a suspect was present at a location—and that does not automatically imply guilt. DNA analysis will be useful in more limited settings. DNA analysis will be useful primarily in rapes (because semen is often recovered) and murders (those in which either the perpetrator's blood was spilled at the crime scene or the victim's blood stained the perpetrator's personal effects—only the former will assist in identifying an unknown suspect). Where it exists, DNA evidence will often be more probative than fingerprints, in that the presence of body fluids is harder to attribute to innocuous causes. That is especially true in rape cases, in which positive identification of semen in the vagina is virtual proof of intercourse (although it leaves open the issue of whether it was consensual). Consequently, the potential utility of a DNA profile

databank must be evaluated in terms of the particular crimes to which it is primarily suited.

- Fingerprints have a defined physical pattern independent of the method of visualization, whereas DNA profiles are derived patterns that can be constructed with various protocols (e.g., different restriction enzymes to cut the DNA and different probes to examine different loci) that produce completely different patterns that cannot be readily interconverted. The advance of DNA technology will see the development of new protocols that offer technical advantages but produce different and incompatible patterns.
- In a sense, current DNA profiles can be thought of as extremely small bits of a person's fingerprints on all or some of the fingers. Different methods look at different fingers or different locations on a finger. Only when DNA technology is capable of sequencing the entire three billion basepairs of a person's genome could a DNA pattern be considered to be as constant and complete as a fingerprint pattern. Consequently, the development of DNA databanks is tied to the standardization of methods. A national DNA profile databank can function only if participating laboratories agree on standardized methods. However, the creation of a databank with current methods could discourage the conversion to newer, cheaper, and more powerful methods.
- The amount of information provided by latent fingerprints in an evidence sample is essentially fixed—it depends primarily on the portion of the finger(s) or palm found—and the forensic scientist uses all of it. DNA typing of an evidence sample yields information in an amount determined by the number of loci studied, so the forensic scientist has substantial control over the amount of information to be obtained from a sample. Consequently, the creation of a DNA profile databank would require decisions about the extent of the DNA profile to be recorded.
- Fingerprints are more highly individualized than DNA profiles based on the RELP technology being used in forensic laboratories. Consequently, a match between an evidence sample and an entry in a DNA profile databank should not automatically lead to the assumption of identity, but should be confirmed by the examination of additional loci that are not in the databank.
- Obtaining an inked fingerprint from a person is much less intrusive, costly, and difficult than drawing a blood sample for DNA typing.

- Collection of fingerprints from known persons is inexpensive and relatively easily accomplished by someone with minimal technical background and training. In contrast, development of a DNA profile from a blood sample is time-consuming and expensive and requires extensive education, training, and quality-assurance measures. Consequently, the number of people who can be included in a DNA profile databank might be limited by economic considerations. Categories of persons to include must be selected with due consideration of costs and benefits.
- The computer technology required for an automated fingerprint identification system is sophisticated and complex. Fingerprints are complicated geometric patterns, and the computer must store, recognize, and search for complex and variable patterns of ridges and minutiae in the millions of prints on file. Several commercially available but expensive computer systems are in use around the world. In contrast, the computer technology required for DNA databanks is relatively simple. Because DNA profiles can be reduced to a list of genetic types (i.e., a list of numbers), DNA profile repositories can use relatively simple and inexpensive software and hardware. Consequently, computer requirements should not pose a serious problem in the development of DNA profile databanks.
- Fingerprints provide no information about a person other than identity. DNA typing can, in principle, also provide personal information—concerning medical characteristics, physical traits, and relatedness—that carries with it risks of discrimination. Consequently, DNA typing raises considerably greater issues of privacy than does ordinary fingerprinting.
- In short, ordinary fingerprints and DNA profiles differ substantially in ways that bear on the creation and design of a national DNA profile databank

1.6 Confidentiality and Security:

Confidentiality and security of DNA-related information are especially important and difficult issues, because we are in the midst of two extraordinary-nary technological revolutions that show no signs of abating: in molecular biology, which is yielding an explosion of information about human genetics, and in computer technology, which is moving toward national and international networks connecting growing information resources.

Molecular geneticists are rapidly developing the ability to diagnose a wide variety of inherited traits and medical conditions. The list already includes simply inherited traits, such as cystic fibrosis, Huntington's disease, and some inherited cancers. In the future, the list might grow to include more common medical conditions, such as heart disease, diabetes, hypertension, and Alzheimer's disease. Some observers even suggest that the list could include such traits as predispositions to alcoholism, learning disabilities, and other behavioral traits (although the degree of genetic influence on these traits remains uncertain).

Obviously, such information could lead to discrimination by insurance companies, employers, or others against people with particular traits. In general, the committee feels that DNA profile databanks should avoid the use of loci associated with traits or diseases. That avoidance is the best guarantee against misuse of such information. Current forensic RELP typing markers are not known to be associated with particular traits or medical conditions, but they might be in the future. Current PCR typing uses the HLA DQ locus, which is in a gene that controls many important immunological functions and is associated with diseases.

Even simple information about identify requires confidentiality. Just as fingerprint files can be misused, DNA profile identification information could be misused to search and correlate criminal-record databanks or medical-record databanks. Computer storage of information increases the possibilities for misuse. For example, addresses, telephone numbers, social security numbers, credit ratings, range of incomes, demographic categories, and information on hobbies are currently available for many of the citizens in our society from various distributed computerized data sources. Such data can be obtained directly through access to specific sources, such as credit-rating services, or through statistical disclosure. "Statistical disclosure" refers to the ability of a user to derive an estimate of a desired statistic or feature from a databank or a collection of databanks. Disclosure can be achieved through one query or a series of queries to one or more databanks. With DNA information, queries might be directed at attaining numerical estimates of values or at deducing the state of an attribute of a person through a series of Boolean (yes-no) queries to multiple distributed databanks.

Several private laboratories in already offer a DNA-banking service (sample storage in freezers) to physicians, genetic counselors, and, in some cases, anyone who pays for the service. Typically, such information as name, address, birth date, diagnosis, family history, physician's name and address, and genetic counselor's name and address is stored with the samples. That information is useful for local, independent bookkeeping and record management. But it is also ripe for statistical or correlative disclosure. Just the existence of a sample from a person in a databank might be prejudicial to the person, independently of any DNA related information. In some laboratories, the donor cannot legally prevent outsiders' access to the samples, but can request its withdrawal. A request for withdrawal might take a month or more to process. In most cases, only physicians with signed permission of the donor have access to samples, but typically no safeguards are taken to verify individual requests independently. That is not to say that the laboratories intend to violate donors' rights; they are simply offering a service for which there is a recognized market and attempting to provide services as well as they can. Much has been written on statistical databank systems and associated security issues.

Guidelines for release of DNA samples and disclosure of DNA typing information must be designed to safeguard the rights of persons who, for one reason or another, get involved in a DNA typing[317] without burdening law-enforcement agencies and civil investigative authorities with unnecessarily protective policies.

Although that is a good start, state laws should state explicitly the types of uses that can be authorized. In particular, in addition to the points made in the opinion just quoted, investigation of DNA samples or stored information for the purpose of obtaining medical information or discerning other traits should be prohibited, and violations should be punishable by law.

1.7 Methodological Standardization:

Because of the incompatibility between DNA typing methods, Central, state, and local laboratories that wish to use a national DNA profile databank must all adopt a single standardized method for analyzing samples—both databank specimens and evidence specimens. Accordingly, the development of a national DNA databank has the

[317] see Chapter 7 for further discussion

potential advantage of acting as a driving force for standardization in forensic DNA typing, but the potential disadvantage of ossifying a rapidly moving technology.

Before even pilot projects can be begun, the degree of interlaboratory reproducibility—which is essential to the success of a databank—should be thoroughly documented. So far, there have been only a few interlaboratory-reproducibility studies to compare the ability of different laboratories to measure the same DNAs accurately under different circumstances.

1.8 Costs versus Benefit:

An analysis of the costs and benefits of establishing DNA databanks is problematic at best. Costs will depend on a number of variables, such as methods, numbers of loci used, and types and numbers of samples to be tested. Benefits will depend on the populations included in the databank and the likelihood of finding matches. Moreover, costs and benefits must be reckoned in both monetary and nonmonetary terms.

Non monetary costs can include the risk of loss of privacy and the misuse and abuse of genetic information. Nonmonetary benefits can include prevention of future crimes. Those diverse elements cannot be weighed except in the context of societal values.

Concerning monetary costs, it is helpful to recall the comparison between latent fingerprints and DNA profiles. Collection of fingerprints from identified persons is inexpensive and relatively easily accomplished by persons with minimal technical training and background. Samples cost perhaps a few dollars; the cost reflects the personnel time involved in taking and filing the fingerprints. Although sample collection is simple, fingerprint databanks require sophisticated and expensive computer hardware and software. A typical state automated fingerprint identification system can cost $10 million.

In contrast, DNA typing is time-consuming, is expensive, and requires extensive education, training, and quality-assurance measures[318]. However, DNA typing

[318] . With current RFLP methods, blood must be obtained by venipuncture at an estimated cost of $20/sample. Storage methods and costs depend on the number of samples and the form in which they are preserved (liquid or dried blood, extracted DNA pellet, buffy coat, etc.). In any case, freezers, cry

databanks do not require highly sophisticated or expensive computer hardware and software.

In short, ordinary fingerprints and DNA profiles have opposite economic characteristics. Ordinary fingerprint databanks have low variable costs and high fixed costs, and DNA typing databanks have high variable costs and comparatively low fixed costs. Those considerations imply that different decisions could be appropriate as to whether, when, and how to develop each kind of databank. For example, because of the high variable cost per sample, considerable thought must given to whose DNA profiles should be stored. To maximize the "return per sample," one should concentrate on persons convicted of crimes with documented high rates of recidivism, such as rape, as discussed below.

Cost analysis is made more difficult by the rapidity of change in DNA typing technology. For example, PCR-based methods might greatly reduce DNA typing costs: blood samples might be replaced with simple buccal swabs (i.e., cheek scraping); Southern blots might be replaced with non-gelbased formats; complicated scoring of the problematic continuous allele system used in RFLP analysis might be replaced with discrete mechanical allele scoring. Accordingly, today's cost assessments must be viewed as tentative.

1.9 Whose samples should be included?

In deciding whom to include in a DNA profile databank, it is necessary to consider the likely forensic utility of the data and the protection of individual privacy. It is helpful to consider six categories of people.

- **Samples from Convicted Offenders**
- **Samples from Suspects**

DNA typing profiles of suspects might also be useful in associating a person with open or unsolved cases pending in other jurisdictions or states. Although a suspect's DNA profile might ultimately be entered into a convicted-felon databank, there would

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tubes, and labor can cost another $20/sample for storage. The cost of RFLP analysis can be estimated from fees charged by private laboratories: about $100-150/sample. Thus, a single DNA profile can cost about $120-170, and constructing 10,000 DNA profiles could cost $1.2-1.7 million

no doubt be a substantial period during which a suspect might engage in other criminal activities. Thus, in the case of a serial rapist, a person under suspicion and investigation for one offense, might be responsible for several later offenses for which he is not suspected. Therefore, if a DNA profile of a suspect is entered into a databank, it would be available to be searched against future unsolved cases.

- **Samples from Victims**

To protect their privacy, victims' DNA profiles should never be entered into a national databank or searched against such a databank, with the possible exception of cases of abduction, in which it might be desirable for the victim's information to be stored and accessible to law-enforcement officials. In any exceptional case, prior permission of the victim, the victim's legal guardian, or a court should be required, and the victim's DNA should be removed from the databank when it can no longer serve the purpose for which it was entered.

- **Samples from Missing Persons and Unidentified Bodies**

This portion of the databank would contain DNA profiles from unidentified bodies, body parts, and bone fragments. These would provide the greatest benefit when DNA profiles from immediate relatives (parents) could be used to reconstruct the DNA profile of a missing person for comparison. Although there would be immediate benefits from the development of these types of data, the actual number of relevant cases would be small, compared with the number of sexual assaults by unknown persons.

- **Crime-Scene Samples from Unidentified Persons**

DNA profile evidence found at the scene of a crime should be stored and accessible to legally authorized investigators. Such samples might be useful for recognizing serial or multiple crimes even before a perpetrator is found and will be equally useful once a perpetrator has been identified. It might be useful to have additional cross-referenced information accessible at the national level, including modus operandi or other attributes for correlation as part of an investigation.

- **Samples from Members of the General Population**

Some observers have suggested that a DNA profile databank should not be limited to criminals, but should aim, at least in the long term, to store DNA profiles from the entire general public. It is argued that many groups in the general public are already required to be fingerprinted for various security and identification purposes and the same justification could be applied to DNA profiles; furthermore, if the databanks contained everyone, rather than just previous offenders, the chance of identifying perpetrators would be much greater.

- **Samples from Anonymous Persons for Population Genetics**

The committee notes that statistical databanks of random population samples are required for estimating allele frequencies, as described in Chapter 3. To protect the privacy of persons whose only role is to make up a statistical sample, their identities should never be retained in a databank, and the databanks should never be searched for matches in connection with investigations.

- **Sample Storage**

Another difficult issue is the storage and maintenance of DNA samples themselves (or any reusable products of the typing process), as opposed to DNA profiles. In principle, retention of DNA samples creates an opportunity for misues—i.e., for later testing to determine personal information. In general, the committee discourages the retention of DNA samples.

However, there is a practical reason to retain DNA samples for short periods. Because DNA technology is changing so rapidly, we expect the profiles produced with today's methods to be incompatible with tomorrow's methods. Accordingly, today's profiles will need to be discarded and replaced with profiles based on the successor methods. It would be extremely expensive and inefficient to have to redraw blood samples for retyping. We are therefore persuaded that retention of samples after typing should be permitted for the short term—only during the startup phase of DNA profile databanks. As databanks become established and technology stabilizes somewhat, samples should be destroyed promptly after typing.

1.10 Information to Be Included and Maintained In a Databank :

It is worth commenting on the nature of the information that should be stored in a DNA profile databank.

- Submitting-agency information should include the location of the agency, its telephone number, names of the analysts who conducted the DNA typing, the name of the person who entered the data into the databank, and agency contact information.
- Sample information should include entries that describe the type of sample (body-fluid stain, tissue, or known blood sample) and a unique sample identifier, the condition of the sample, unusual handling and storage, and other factors that might affect the quality of the DNA and the evaluation of partial patterns.
- The DNA type at a locus must be entered in standard nomenclature. For example, for RFLP typing, fragment-size data from each locus successfully probed should be entered as the number of base pairs determined for each fragment. Sizing data for the human-DNA control should also be entered.
- Entries into the convicted-offender files should include the name of the offender, dates of offenses and convictions, and DNA profile data. Only the profile index should be centrally stored. Case data should be stored locally, and their distribution should be under the control of the local agency.

1.11 Rules on Accessibility:

Computer security should be ensured through use of the best available practices and technologies. Access to the databank should be limited to a small number of legally authorized persons and should be limited to what is required for specific official investigations. All instances of access should be audited and archived. An excellent discussion of computerized audit-trail systems is available.

If the computer system and associated databank are to be made available for remote access by cooperating state and federal agencies, such as by telephone or networked by other means, the access mechanism (i.e., the network switch) should be made available only for specific, authorized remote-access sessions; that is, the system

should not be continuously available to remote users. This type of limited access can be achieved either administratively or physically; it is a simple and inexpensive means of safeguarding sensitive information and is common practice in many national security situations. For example, secure computers are virtually never connected to unsecured computers at national defense laboratories; when newspaper headlines make statements that computers at these facilities have been breached, it has been the case that the computers were unsecured and not connected to the secure computers. In many cases, these unsecured computers have telecommunication connections available to employees for routine use, but they do not contain security information.

1.12 Status of Databank Development

local\district level-

State Level

Central level

The national databanks would reference the sources of the profiles, but case data would be secured and controlled by the state and local agencies.

It would coordinate quality assurance with a technical advisory group to implement appropriate guidelines; coordinate with other agencies that have a law-enforcement interest in the development of the databank; provide hardware and software for the databank server and for state access to the databank; provide hardware to store and back up the databank server; provide training for states in forensic DNA technology, quality control, and databank access; determine formats for databank input and output; update index with new state and federal submissions; assemble population data for all probes used and calculate and disseminate population frequencies; and modify the system to accommodate new DNA typing methods[319].

State and local agencies would be responsible for performing DNA analyses of samples with consensus methods; submitting new information in a specified format for incorporation into the databanks; guaranteeing the quality of their new

[319]See "DNA Technology in Forensic Science",National Academic Press, Available at http://www.nap.edu/openbook.php(Last accessed on 23rd Sept. 2009)

submissions; providing hardware and software for state image-analysis workstations for telephone access to centralized index; maintaining centrally indexed case files for as long as they remain in the index; and providing relevant information from case files that are indexed centrally to other law-enforcement agencies, which subscribe when requested.

Local autonomy as to databank structure and function is recommended, for several reasons: a databank can be tailored to meet local needs, the local databank administrator will not have to rely on outside entities for maintenance and change, and security can best be managed with smaller, discrete, well-understood databanks. That is not to say that standards and guidelines should be avoided. On the contrary, very strict regulations, standards, and guidelines for all aspects of the operation should be enforced and monitored. Databank requirements involve determining what a system must accomplish; there are typically many alternative implementation details that can accomplish the same goals.

1.13 Summary of Recommendations:

- In principle, a national DNA profile databank should be created that contains information on felons convicted of violent crimes with high rates of recidivism. The case is strongest for felons who have committed rape, because perpetrators typically leave biological evidence (semen) that could allow them to be identified. The case is somewhat weaker for violent offenders who are most likely to commit homicide as a recidivist offense, because killers leave biological evidence only in a minority of cases. The wisdom of including other offenders depends primarily on the rate at which they are likely to commit rape, because rape is the crime for which the databank will be of primary use.
- There are a number of scenarios that illustrate the point that the databank need not be limited to persons convicted of specified crimes.
- The databank should also contain DNA profiles of samples from unidentified persons collected at the scenes of violent crimes.
- Databanks containing DNA profiles of members of the general population (as exist for ordinary fingerprints for identification purposes) are not appropriate, for reasons of both privacy and economics.

- DNA profile databanks should be accessible only to legally authorized persons and should be stored in a secure information resource.
- Legal policy concerning access and use of both DNA samples and DNA databank information should be established before widespread proliferation of samples and information repositories. Interim protection and sanctions against misuse and abuse of information derived from DNA typing should be established immediately. Policies should explicitly define authorized uses and should provide for criminal penalties for abuses.
- Although the committee endorses the concept of a limited national DNA profile databank, we doubt that existing RFLP-based technology provides a wise long-term foundation for such a databank. We expect current methods to be replaced soon with techniques that are simpler, easier to automate, and less expensive—but incompatible with existing DNA profiles. Accordingly, we do not recommend establishing a comprehensive DNA profile databank yet.
- For the short term, we recommend the establishment of pilot projects that involve prototype databanks based on RFLP technology and consisting primarily of profiles of violent sex offenders. Such pilot projects could be worthwhile for identifying problems and issues in the creation of databanks. However, in the intermediate term, more efficient methods will replace the current one, and the forensic community should not allow itself to become locked into an outdated method.
- State and central laboratories, which have a long tradition and much experience with the management of other types of basic evidence, should be given primary responsibility, authority, and additional resources to handle forensic DNA testing and all the associated sample-handling and data-handling requirements.
- Private-sector firms should not be discouraged from continuing to prepare and analyze DNA samples for specific cases or for databank samples, but they must be held accountable for misuse and abuse to the same extent as government-funded laboratories and government authorities.
- Discovery of a match between an evidence sample and a databank entry should be used only as the basis for further testing using markers at additional loci. The initial match should be used as probable cause to obtain a blood

sample from the suspect, but only the statistical frequency associated with the additional loci should be presented at trial.

2. Advantage of DNA:

The main advantage of this technique is its ability to analyze small and environmentally challenged samples and to accurately establish their origins with a high degree of certainty. One of the major advantages of DNA typing is that DNA is much resistant to degradation caused by the environmental conditions. Moreover, DNA is somatically stable. It generates the same genetic pattern irrespective of the biological material like hair, seminal stains, fresh blood, soft tissue, hard tissue, etc. In fact, this unique feature of DNA makes it a powerful tool in forensic identification DNA can be successfully obtained from blood and blood stains, vaginal and anal swabs, oral swabs, well worn clothing, bone, teeth, most organs and to some extent urine, Salova per se has few nucleated cells, but beer and wine bottles, drinking glasses, beer cans, soda cans, cigarettes, stamps and envelope flaps have all been found to provide varying amounts of DNA. This show DNA finger printing can connect the crime scene or from a body to another particular individual.

Except DNA, other markers get degraded very soon. The main factors of degradation include temperature, time, and humidity – which lead to the growth of microorganisms, exposure to ultra violet sunlight and various chemical substances, which are often found together the environment. But DNA is much more resistant to these factors caused by the environment conditions. It is reported that even if biological material gets degraded, it is possible to conduct DNA it remains stable except it gets broken into smaller fragments. Report on forensic application of DNA tests are emerging which seems to work with even dried blood stains as sperms making it potentially valuable in criminal investigation.

3. Reliability on the technique:

Now question arises whether we can rely on this technique. By giving emphasis on following points we can believe in its reliability.

(i) Extensive use of the technique in medical science for a longer period.

(ii) Nobody argues against its reliability.

(iii) The probability result is so high and positives that it leads to certainty.

(iv) A further component of reliability is the frequency with which a technique leads to erroneous results. But in DNA fingerprinting as testimony if there was something wrong with the process, it would ordinarily lead to no result being obtained rather than erroneous result.

(v) Control samples are provided with main sample to avoid error. These prove its reliability.

DNA evidence will be in its success path with strong and rebuts legislation and reputed laboratories with standardized operational procedures. Laboratory must be well equipped and technicians must be highly skilled. Laboratory must function in collecting samples properly and promptly with proper documentation authorized by law and proposed legislation. These will leave no space for dispute; rather will help in eliminating the scope for disputes. Giving emphasis on this point is that carelessness or ignorance of proper handling process during collection, preservation and transportation of biological samples from the crime scene to the DNA analysis laboratory can render a specimen unfit for analysis. Each sample should be labeled carefully with proper sealing and identification marks. The DNA analysis report was not accepted by the Court of law in case of a very famous football player. OJ Simpson and the suspect were acquitted on the ground that samples were not collected and handled properly.

4. Challenges for DNA investigators-

- Requires that collection of evidence must be systematically recorded and access to evidence must be controlled Special challenges for DNA samples.
- Crime scene may have DNA from people other than perpetrators of crime.
- DNA collected from victims in a morgue can become contaminated by DNA of other bodies previously on autopsy table.
- Lack of standardization of DNA procedures.
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(a) What every Law Enforcement Officer should know about DNA Evidence?

-What is DNA?Can DNA be wrong ?

-Identifying DNA Evidence

-Evidence Collection and Preservation

-Database of DNA profiles

-Common Problem-

(b) Identifying DNA Evidence

Some common items of evidence, the possible location of the DNA on the evidence, and the biological source containing the cells should be known.

(c) Evidence Collection and Preservation

Every officer should be aware of important issues involved in the identification, collection, transportation, and storage of DNA evidence. Given the sensitive nature of DNA evidence, officers should always contact their laboratory personnel or evidence collection technicians when collection questions arise.

(d) Database of DNA profiles

Just as fingerprints found at a crime scene can be run through in search of a suspect or link to another crime scene, DNA profiles from a crime scene can be entered into the database.

Therefore, law enforcement officers have the ability to identify possible suspects when no prior suspect existed.

(e) Common Problem

- Band shifting May lead to wrong conclusions

We need to be careful, sensitive and aware DNA is unchangeable information about an individual or population, therefore can be used or misused.

We should be sensitive to ethical and social outcome of the information. It should not lead to discrimination to minorities, crime prevention discrimination, forceful DNA sampling etc.

Storage of DNA and DNA test results should be highly secured

Storage of authorization, national boundaries and legal limits should be chalked out carefully

(D) Abuse and Misuse of DNA Information[320]-

Even if a technology is scientifically sound and its use is ethically permissible, it is necessary to seek to prevent abuses and misuses in practice. Examples of abuses of DNA technology are unauthorized access to databanks and unauthorized disclosure of information. An example of misuse is the use of DNA information for purposes other than forensic—in other words, going beyond the intended purpose of collecting and storing the information.

A major issue is the preservation of confidentiality of information obtained with DNA technology in the forensic context. When databanks are established in such a way that state and federal law-enforcement authorities can gain access to DNA profiles, not only of persons convicted of violent crimes but of others as well, there is a serious potential for abuse of confidential information.The victims of many crimes in urban areas are relatives or neighbors of the perpetrators, and these victims might themselves be former or future perpetrators. There is greater likelihood that DNA information on minority-group members, such as blacks and Hispanics, will be stored or accessed. However, it is important to note that use of the ceiling principle removes the necessity to categorize criminals (or defendants in general) by race for the purposes of DNA testing and storage of information in databanks.

Maintaining DNA samples or information about ex-offenders and parolees might be permissible, but requires justification. Even in a felon databank, protections must be

[320] Ibid 319

instituted. For example, a person's permission should be obtained for the use of his or her DNA information outside the forensic context. If there are no witnesses to a crime, law-enforcement agencies are likely to go directly to the felon databank in their quest for probable suspects. The tendency to use efficient and cost-effective means to solve crimes could result in reducing safeguards, thereby eroding rights of ex-offenders and parolees.

Storage of DNA records of people who have not been convicted of a crime raises ethical questions about the proper "ownership" of such information. DNA information is personal and so should be treated as private, like information in a person's medical record. Outside the forensic context, DNA information should be stored in databanks and released only with the knowledge and explicit permission of the person who is the subject of the information. As for storage of forensic DNA information in databanks, some disagreements remain about propriety and about the prospects for abuse).

Even when the use of criminal databanks is limited to the local or regional level, the potential for expansion raises questions of misuse. For example, should a whole local population be subject to DNA typing when it is strongly suspected that someone in the population left blood or other fluids at the scene of the crime? Should this be seen as similar to a "frisk" or a simple search that requires a warrant or as an intrusion into someone's body that requires a strong showing of need? The potential for expanded

uses of DNA technology that would constitute serious intrusions into the privacy of ordinary citizens requires the setting of guidelines that separate proper use from misuse of the technology.

The release of DNA information on a criminal population for purposes other than law enforcement also constitutes misuse. Employers and insurance companies will certainly have an interest in DNA information on potential employees or customers. Biomedical and behavioral scientists are likely to want to screen felon databanks and develop new databanks to study various characteristics of convicted offenders. Legal sanctions should be established to deter the unauthorized dissemination or procurement of DNA information that has been obtained for forensic purposes.

(E) Suggestions for Use of DNA Evidence[321]

Whatever statute or rule of evidence is applicable, some standards for admissibility seem sound to the committee. In view of the importance of DNA typing in both civil and criminal cases, the judge should determine, before allowing DNA evidence to be introduced, that appropriate standards have been followed, that tests were adequately performed by a reliable laboratory, and that the appropriate protocols for DNA typing and formulation of an opinion were fully complied with. In states without relevant statutes, the committee recommends that the court judicially notice the appropriateness of the theoretical basis of DNA typing by using this report, similar reports, and case law. As new methods are used, the courts will have to assure themselves of their validity.

The problem that a court will have to focus on when a standard testing approach is used is not general scientific theory, but actual application. *In limine* hearings can be shortened considerably by stipulations, exchange of data by the parties, and pretrial hearings to avoid unnecessary delay in trials. In the absence of specific objections to laboratory procedures, a court may rely on evidence of accreditation and certifications, a history of adequacy of testing by the laboratory, and other assurances of careful practice. It is not necessary, at this stage of development of DNA typing, to hold extensive admissibility hearings on the general validity of the scientific techniques, although cases will still arise in which the procedures used to report a match will be questioned.

It also might be necessary in a particular case to decide in advance whether an expert will be permitted to characterize the probability of a match in mathematical terms. the use of the product rule (which assumes the independence of the frequency distribution of the single-locus probes and is the method by which the likelihood statement is generated) is controversial. At present, courts should take a conservative approach concerning the assumptions underlying the use of the product rule. A considerable degree of discretion and control by the courts in these cases is recommended.

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[321] Ibid 319

As a general matter, so long as the safeguards we discuss in this report are followed, admissibility of DNA typing should be encouraged. There is no substantial dispute about the underlying scientific principles. However, the adequacy of laboratory procedures and of the competence of the experts who testify should remain open to inquiry. Ultimately, DNA typing evidence should be used without any greater inconvenience than traditional fingerprint evidence.

5. Barriers to Realizing the Potential of DNA Evidence:

Despite the exciting promise of DNA Technology, a number of barriers remain, to realizing its full potential. One of these barriers is the frequent failure of law enforcement to identify and collect appropriate DNA evidence from the crime scene. Many law enforcement agencies have not been properly trained to recognize and collect potential DNA evidence, and this situation leads to an unnecessary disadvantage for the investigation prosecution, specially in sexually assault cases: [322] For Example:- A recent FBI survey revealed that of all sexual assault cases, less than 10% had DNA evidence submitted to Crime Laboratories [323] Other barriers include the failure to effectively evaluate DNA evidence for analysis, lack of communication between enforcement and crime personnel, limited resources, and the use of incompatible systems for DNA analysis. The major barrier in India is that of corruption, faking of forensic reports, production of false reports for evidence and most importantly the political influence of the accused as was seen in sensational Madhumita Shukla case of Uttar Pradesh[324]

Failure to effectively evaluate DNA evidence: When analyzing DNA evidence, processing a pure sample, such as blood or saliva. Swab is only a small part of process. Much of the evidence with DNA potential is not pure but rather collected from crime scene (from clothing or bedding etc.). The problem with this type of evidence is that it requires effective evaluation by Law Enforcement in order to provide information to assist crime lab personnel in their analysis. Unfortunately, Law

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[322] Sushil Sharma Vs. State of (Delhi Administration) 1996 Cr. L.J. 3944

[323] 509, US 579, 59 (1993) Weedn & Hicks (1997)

[324] Madhumita Shukla Murder Case where state politician Amarmani Tripathi was the accused 2002 Cr.L.J. 396

Enforcement has traditionally received very little training in how to evaluate potential evidence in this way.

Lack of communication between Law Enforcement & Crime Laboratory: Just as police officers often fail to understand how effectively collect and evaluate evidence for analysis, a traditional lack of communication and interaction with crime lab personnel has also limited the contribution of DNA Technology. Absence of forensic science expert or crime lab personnel at the crime scene at the time of collecting DNA evidence also adds up to one of the barriers of DNA Technology.

Limited Resources:

In addition to these problems that result primarily from a lack of appropriate training and communication, both law enforcement agencies and crime laboratories suffer from limited resources that further hinder the contribution of DNA technology. This situation is especially pronounced for sexual assault, as these cases typically make up the majority of the DNA work performed. This is evident from the fact that in India there are only 4-Central Forensic Science Labs, 20-State forensic Labs, 3-Central Document Examination Labs

Use of incompatible systems for DNA analysis: To further complicate matters, even when evidence is appropriately collected, screened and analyzed for DNA, it can be limited in its contribution by the use of incompatible systems. Forensic laboratories have used different DNA testing systems, including DQAJ, Polymarker, RFLP ; PCR and STR. Labs will sometime even utilize one analytic system for trying scene evidence and another for the suspect's reference standard. Results are therefore frequently found to be incompatible with Each other and/or with the state databanks or CODIS15

Perpetua Lex Est Nulluum Legem Humanum Ac Positivam Perpetuam Esse Et Clausula Quae Abrogationem Excludit Ad Initio Non Valet- No Law Can Be Permenant And A Law Which Takes Always A Power Of Repeal Is Abinitio Void

6. Overcoming the Barriers (Suggestions):

To overcome the barriers those are hampering the development and extensive use of the DNA Technology in crime investigation and detection, following are the steps, which can help in overcoming the barriers in realizing the potential of DNA evidence. Requisite training should be imparted to the law enforcement officers involved in collecting the DNA evidence at the crime scene. They should be taught about collection of the samples from crime scene and preservation of the same. Frequent fresher courses should be held in this connection to impart latest technology in the line.

- Steps should be taken to bring forensic science in the forefront of criminal justice administration. So the presence of Forensic Lab Personnel at the time of collection of DNA evidence at the crime scene should be made compulsory under the Law.
- Since there is possibility of delay in collecting DNA samples from the place of occurrence, Submission of the same to the laboratories for test or the samples being tempered during transit, evidence should be lead to rule out these possibilities.
- DNA tests may be preferably be got conducted under the orders of the Court.
- A network of standardized Forensic Laboratories should be laid down in the country, which should be well equipped and must function with proper documentation authorized by the Legislation.
- Provision should be made to make a National DNA Databank, on the basis of CODIS maintained by FBI. Initially to start with the samples of DNA of prisoners should be collected as their finger impressions are taken and record maintained by the Govt. after their convictions under Identification of Prisoner's Act, 1920.
- As recommended by the Malimath Committee in its report, that 'DNA expert be included in the list of experts' and also recommended that an amendment should be made in Cr.P.C, 1973. And the same needs to be done.

7. Amendments in Law -Some suggestions

Fortior Et Potentior Est Dispositio Legis Quam Hominis- Law Is Stronger And More Powerful Then Any Man

Nova Constitio Futuris Forman Imponere Debet, Non Proteritis –New Laws Are Prospective Not Rtrospective

The proposition of law laid down by the Andhra Pradesh was followed by Calcutta High Court. However, Bombay High court in a latter decision considered the entire proposition of law and was of the opinion that it as high time that law be made specific on the question by amending the Evidence Act. A single Judge of Bombay High Court in this case held thus.

Then the law makers also may examine whether a special provision should be made in the Evidence Act to provide for taking blood samples of the parties concerned and the child concerned in order to decide about the paternity or maternity of the child. In the very nature of things, even if such a provision is made and the Court directs a party to give blood sample and the party refuses, the Court cannot enforce the individual to give blood who refuses to give sample blood. In such a case, the law may also provide as to how the order of the Court should be complied with or as to what should happen if the order to the Court is not complied. One consequence will be that the Court may draw an adverse inference from the conduct of the party who refuses to give blood sample in spite of the directions of the Court, then the law makers may also consider the question whether the pleading of a party who refuses to obey the order of the Court ma be struck off or may be prevented from prosecuting the case or from defending the case."

The Bombay High Court directed the Central Government, Law Commission of India, Ministry of Law and others for amending the Evidence Act to provide the circumstances under which blood samples can be taken from the spouse and their

child or others to test the disputed paternity and for any other test like DNA or any other scientific test and the circumstances in which such tests can be taken[325].

Since DNA test can also be successfully carried out of any part or tissue of body, hair, bone, skin, tooth or even saliva taken while one as alive or even dead, the question would arise as to what rules should govern the taking of DNA sample from a dead body or mummy, even taking it from grave.

Recently the Indian Evidence (Amendment) Bill, 2003 has been proposed on the recommendation of the 185th Law Commission Report. The bill provides for DNA tests in paternity disputes. Scientific evidence frequently plays a key part in both civil and criminal trials and the scientific investigation of evidence left at the crime scene can seem more persuasive to a Court than the testimony of eyewitnesses. The Scientific and Technological proceeds in the process of identification of an individual are of paramount importance predominantly in a forensic set up. Several techniques have been developed for this purpose, simple example of which is fingerprints of an individual. One of the newest forms of forensic evidence is DNA Fingerprinting, which uses material from which chromosomes are made to identify individuals positively. The use of DNA evidence is anticipated to become a universal place in the 21st century. It is considered to be a major breakthrough in forensic science in this century. It has been subjected to the most comprehensive, scientific examination as no there twig of forensic science, and has currently established itself as one of the best with mounting applications. It is now a well-recognized technique, which is not only used in numerous areas of research in modern molecular biology and genetics but also finding prospective applications in our day-to-day life. DNA fingerprinting is based on the principle that the genetic make up of every individual is different from the others but is unique and idiosyncratic to an individual. DNA fingerprinting is the only definite, positive and permanent identification method of a person as one's lifetime. DNA testing takes advantage of the fact that, with the exception of identical twins, the genetic material – DNA – of each person is unique. DNA evidence, like fingerprint evidence, offers prosecutors important new tools for the identification and apprehension of some of the most violent perpetrators. At the same time, DNA aids

[325] See, Article Available at http://www.answeringlaw.com/php/displayContent.php(Last accessed on 2nd May 2009)

the search for truth by exonerating the innocent. DNA fingerprints are useful in several applications of human health care research, as well as in the justice system. They are used to diagnose inherited disorders in both prenatal and newborn babies in hospitals around the world. Research programs to establish inherited disorders on the chromosomes depend on the information contained in DNA fingerprints. They are also used to link suspects to biological evidence. Another use of DNA fingerprints in the court system is to establish paternity in custody and child support litigation. Advances in technology are leading to novel uses of DNA fingerprinting almost every day.

7.1 Drastic changes required in India.....

Summum Jus Summa Injuria – A Strict Law Causes Most Harm;

Summum Jus Summa Injuria – A Strict Law Causes Most Harm[326]

There should be no shame in errors made by well-meaning jurors, because human error is inevitable. But what is deeply shameful is when these Judges feel helpless in taking any decision in the absence of any legislation providing for DNA examination and also because of the non-existence of any provision providing for the same in the Indian Evidence Act. For the successful in corporation of this technique in this country various scientific and legal reforms are required. This is high time that the suitable amendments must be made in the Indian Evidence Act. Legislature should craft a worthy piece of legislation that primarily would maximize the use of DNA evidence to punish the guilty and protect the innocent, as has done in Canada, USA and UK. There is no been point in lagging far behind the advanced countries because of the lack of scientific awareness. Step has been taken by proposing The Indian Evidence (Amendment) Bill, 2003. In Sec. 112, i.e. section regarding paternity disputes, apart from the sole exception of 'non-access', other exceptions by way of blood-group tests, DNA have been proposed but subject to very stringent conditions. The bill provides for DNA tests conducted in the cases of paternity disputes by the consent of the man and in the case of the child by permission of the court, that man is not the father of the child. It also provides that in case the man refuses to undergo the

[326]See, Article available on http://www.forensic-evidence.com/site/EVID/DNAexonerations.html (visited on 6th February 2010)

DNA test then he shall be deemed to have waived his defense to any claim of paternity made against him. According to this proposed amendment, DNA tests can result in proving definitely that a person is not the father, where the samples do not match. But where the samples match, the controversy remains. If the DNA data is less and does not cover the whole population of a country, the matching is weak evidence. Where the DNA data is available for a larger population or for the whole country; naturally, the probability about the identity of the person will be far less than in a smaller population. Therefore, as in the case of blood-group tests, science has progressed to this extent that where the samples of the male and the child do not match, it is certain that the male is not the father. But, where they match, it leads us to a theory of probability. It has been proposed that as in the case of blood tests, there can be evidence by way of DNA tests to prove that a person is not the father. But DNA evidence cannot be used to say that a person is the father.[327] I think that 'match' must also be given the same treatment because the probability is same in the cases, being it 'match' or 'miss-match'.

Many a time the Courts have expressed their inability in giving any order for DNA examination or even for blood test because as according to the law in India one cannot be forced to give his blood sample and a number of times objections have been raised to such an order, in many cases it has been contended that such an order would violate the rights of an individual enshrined under Art, 21 of the Indian Constitution. Through such an objection has been well answered and has been rightly rejected by the Hon'ble Supreme Court in the recent of Sharda v. Dharampal, [328]If a person has committed an offence, then why will he volunteer to give a specimen of blood knowing fully well that it will convict them? Such a law, which prohibits taking blood, samples forcibly without the wishes of an individual, for medical examination is rather protecting the offenders, which from no angle of vision can be the purpose of law. Even in well developed countries like Canada and Britain forceful blood examination is permitted to serve the ends of justice. It also cannot be said that proof coming out from DNA cannot be self-incriminatory because it is naturally present in the body, thus any proof derived from it cannot be self-incriminatory.

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[327] 19th Law Commission's Report
[328] AIR 2003 SC 3450.

There is a need for the enactment of a legislation providing for DNA examination and establishment of a National Commission, which will keep abreast of all new technological developments for scientists and lawyers alike. The commission will formulate the procedure, standards and quality control and will provide official approval to the testing laboratories.

The legislation must provide that:-.....

- DNA evidence should not be collected from a suspect unless the information is relevant to a specific crime in question and it must not be collected from suspects as a matter of routine.
- There should be reasonable grounds for suspecting that the person committed the offence before taking the DNA sample.
- As a privacy safeguard, DNA evidence should be collected from a suspect only if a judge authorizes the collection.
- The legislation should also provide for the eligibility of the scientists conducting the DNA tests.
- The legislation should also authorize collection of DNA samples from persons convicted of specified felony offences which, military offenders, and terrorism related offences. Because of their DNA record it would be much easier to trace the criminal and also it would save a lot of time of police.
- The legislation should also provide that the police officers must be properly trained for collecting samples for DNA test, from the crime scene.
- The legislation should also permit storage and maintenance of DNA data of crime scene Specimens, unidentified human remains and relatives of missing persons.
- Interest Republicae Ne Matifia Remaneant Impanita –In The Interest Of the Republic Crime Should Not Go Unpunished

The crime scenario in the 21st century has become very complex. The *modus operandi* of crime has become scientific; hence it is essential to use science and technology in apprehending the criminals. Improved testing technologies are emerging, that provides efficient and effective DNA evidence possessing which promise to widen the use of DNA evidence and thus aids in search of truth by

exonerating the innocent. The development of DNA technology furthers the search for truth by helping police and prosecutors in the fight against violent crime. Through the use of DNA evidence, prosecutors are able to conclusively establish the guilt of a defendant. So, the importance of DNA technology in the administration of Justice in any form of society and in any part of the world cannot be denied. With reference to India there is no adequate legislation enacted by the Government on DNA technology. It is imperative to incorporate DNA technology in an Indian Legislation or to draft an exclusive independent enactment on the use of DNA technology in Indian Courts. In India, The Code of Criminal Procedure, 1973, Indian Evidence Act, 1872 are too old. An exclusive law or Act (other than the amendments in the provisions of Cr.P.C and the Indian Evidence Act) as in America, England, and New Zealand and in Canada should be legislated by our Parliament, so that this technique could be effectively used as valuable evidence in the administration of Criminal and Civil Justice.

The Parliament has already established Advisory Committee to look into some of these aspects. One hopes this is sorted out at the earliest so that we can proceed with full swiftness on this path in the furtherance of truth. Then only the real meaning of "Satyamev Jayate" can be really manifested is appropriate to quote Austrian Jurist Eugene Ehrlich, "Positive Law, which is enacted, cannot be effective law, if it were at odds with the cultural pat tern of people (Living Law) "[329]

7.2 The Need for Judicial Education

Evidence based on genetic test results is a form of opinion evidence, which is admissible if it is from an expert. DNA evidence that is relevant to a fact in issue is admissible in civil proceedings unless it is barred under an exclusionary rule, or by judicial discretion. To illustrate judicial discretion, we may refer to the decision of the Supreme Court of India in Gautam Kundu v. State of W.B[330], in which, in context of maintenance of a child under Section 125 of the Code of Criminal Procedure, the father disputed paternity and demanded blood grouping test to determine parentage, the Court held that, where purpose of the application was nothing more than to avoid payment of maintenance, without making out any ground whatever to have recourse

[329] 34 Dr.P.C.Shekharan, Forensic Science in Criminal Investigation, Encyclopedia of Police in India, Pg1862

[330] (1993)3 SCC 418

to the test, the application for blood test cannot be accepted. It was also held that no person can be compelled to give sample of blood for analysis against his / her will and no adverse inference can be drawn against him / her for such refusal.

In the light of the often highly scientific nature of genetic test results, judges will need to balance the probative value of genetic evidence against its potential prejudicial effect when considering whether to admit such evidence. Once the evidence is admitted, the expert scientific witness must explain the science and technology involved in the genetic test, the interpretation of the results, and their significance to the Court. In addition, each party's counsel must have sufficient understanding to examine or cross-examine the expert witnesses appropriately. The judge must also have sufficient understanding to evaluate the evidence. Justice Ming Chin of the Supreme Court of California has commented in the following terms on the potential implications where genetic evidence is admitted in court proceedings:

"The use of genetic information in court raises new evidentiary challenges. DNA evidence is often complicated and laborious to present, and those without a scientific background – including most judges and jurors – often have difficulty understanding it. A courtroom is not an ideal forum for resolving conflicts between scientific theories, yet judges will constantly be asked to referee battles among lawyers and scientific experts over the acceptance of DNA evidence. The complexity and rapid development of genetic science will exacerbate the problem. Scientists need ongoing dialogue and continuous re-examination to test their theories. In courtrooms, decisions must be made at the close of the evidence. This reality creates a natural tension between science and the law."[331] In the United States, an organization known as the Einstein Institute for Science, Health and the Courts (EINSHAC) provides education to judges, courts and court-related personnel in relation to a number of scientific and technical areas, including genetic evidence.

"Our calling is to make science accessible to the instruments of justice. Our mission is to provide judges, courts and court-related personnel with knowledge tools related to

[331] NHMRC's Australian Health Ethics Committee,
"Essentially Yours: The Protection of Human Genetic Information in Australia Available at http://www.nhmrc.gov.au/your_health/egenetics/practitioners/education.htm(See Para 46.23 of the ALRC Report – 96)

criminal and civil justice proceedings involving evidence from the genetic sciences – genetics, molecular biology, biotechnology and molecular medicine – and from new discoveries and technologies in the environment and neuro-sciences. In sum, we emphasize the science and impacts of ... technologies in judicial system proceedings."

Therefore, the National and State Judicial Academies and the Bar Councils should develop and promote continuing legal educational programmes for judges and legal practitioners, respectively, in relation to the use of genetic information in the courts.

7.3 Social awareness about the issue

We have recently advanced our knowledge of genetics to the point where we can manipulate life in a way never intended by nature.

We must proceed with the utmost caution in the application of this new found knowledge[332].Time for legal system and science to work together

The gene revolution is forcing judges to deal with science in a way they never had to before.Questions about the legal relationship between an egg donor, her husband, person being cloned, a surrogate mother and the resulting Child, legal rights , privileges and immunities a cloned child could claim in a jurisdiction that bans human reproductive cloning.

7.4 Transportation and Storage

The first responding officer may be called upon to transport evidence from a crime scene. As with any evidence, the officer should ensure that the chain of custody is maintained. In addition, they should be aware that direct sunlight and warmer conditions may degrade DNA, and avoid storing evidence in places that may get hot, such as the trunk of the police car. To best preserve DNA evidence, store in a cold environment.

[332]See,Article,Availble at http://www.agbioworld.org/biotech-info/articles/agbio-articles/gm-crop-role.html (Last Accessed on 5th May 2010)

Any probative biological sample that has been stored dry or frozen, regardless of age, may be considered for DNA analysis. Nuclear DNA from blood and semen stains more than 20 years old has been analyzed successfully using polymerase chain reaction (PCR). Samples that have been stored wet for an extended period of time should be considered for testing only using PCR and may be unsuitable for DNA analysis. Mitochondrial DNA analysis has been performed on very old bones, teeth, and hair samples.

Samples generally considered unsuitable for testing with current techniques include embalmed bodies (with the possible exception of bone or plucked hairs), pathology or fetal tissue samples that have been immersed in formaldehyde or formalin for more than a few hours (with the notable exception of pathology paraffin blocks and slides), and urine stains. Other samples such as feces, fecal stains, and vomit can potentially be tested, but are not routinely accepted by most laboratories for testing.

8. DNA evidence and the various parties in the legal system- role of various agencies

8.1 Role and Duties of DNA Forensic Laboratories

An appropriate standard for the operation of testing laboratories and the collection and analysis of DNA samples is very important. Uniformity in reporting, completeness of reporting (including laboratory protocols and written criteria for interpretation), and stringent quality assurance of laboratories are essential. The court and the jury should have no reason to doubt the accuracy of the processing of information. Laboratories and experts have a particular responsibility to ensure that they are open and candid with the courts. Any reservations about inadequacies or errors should be promptly revealed, and failure to do that should be dealt with seriously. The court should not hesitate to exercise contempt powers and exclude experts who have misled deliberately in the past. Private trade associations and other appropriate groups should also apply pressure to ensure accuracy and candor.

(i) Interpreting DNA Test Results. : No matter which type of DNA testing is used, the technicians performing the test must interpret the results in some way. First, the examiner must decide whether the DNA fragments in the crime scene sample match

the suspect's DNA. Second, the examiner must estimate the probity of the match; in other words, is the DNA pattern so common that it could have come from any number of people or is it so uncommon that it could have come from only a few individuals?

(ii) Declaring a Match. : In both PCR-based and VNTR profiling, the analyst compares the location and size of the bands on the autorad to see whether any of the bands resemble each other. Labs impose two conditions for declaring a match: First, the examiner must believe that the suspect's fragments have migrated the same distance on the gel; second, computerized measurements must confirm that the difference in migration distances is less than some standard deviation of a set of independent measurements of fragments taken from one sample.

(iii) Evaluating the Probity of the Match: Principles of Population Genetics. Evidence that the suspect's DNA matches DNA taken from the crime scene is not the end of the evaluation. Declaring a match would not be particularly probative if the suspect's DNA were so common that it was very likely to match the crime-scene DNA. The analyst should be able to estimate the chance of a match if the suspect is the source of the sample compared to the chance of a match if someone other than the suspect is the source.

To make this comparison, the examiner must estimate the relative frequency with which the incriminating DNA fragments appear in the relevant population. That frequency usually is determined by comparing the crime-scene DNA profile with some reference data set. But because available databases contain only a very small proportion of the trillions of possible profiles, the frequency of a given profile must be estimated based on the frequencies of individual alleles. Making that estimate involves assumptions about the mating structure of the population.

Obviously, populations do not mate at random. Many people are more likely to choose a mate from the same geographic area, ethnic group, or religion. Furthermore, in some societies people choose mates based on physical and behavioural attributes, such as height and personality. In fact, empirical studies have shown that the population of the United States includes different population groups and subgroups with different allele frequencies. Thus, estimates of the frequency with which an allele appears in the population at large must take into account slight differences among

various populations. The National Research Council's second report, discussed in more detail in section III(D), suggests procedures that take into account such deviations from Hardy-Weinberg proportions.

A related concept is that of *linkage equilibrium.* If mating and selection were truly random, and the entire population therefore had the same allele frequencies, then an analyst could calculate the frequency of a certain genotype simply by multiplying together the frequencies of each of the individual alleles that compose the genotype. Population geneticists would say that such a population is in linkage equilibrium. But in fact we know that loci on some chromosomes tend to be inherited together and thus are in *linkage disequilibrium.* What effect does that fact have on calculating the frequency with which certain genotypes appear in the population? The answer is complex and, like the concept of *Hardy-Weinburg equilibrium,* has contributed to much of the controversy concerning DNA profiling. The National Research Council's second report examined empirical data on linkage disequilibrium suggested formulae for calculating frequencies that it claims are correct to within a factor of about ten-fold in either direction.

8.2 Crime Laboratory Managers:

Funding to further automate and improve the infrastructure of State, and local crime labs so they can process DNA samples efficiently and cost-effectively. Access to the latest training, information, and resources for the forensic scientists who work in our Nation's crime laboratories is critical to ensuring the most effective use of this technology

i. Recommendations for Laboratory Personnel-

A DNA testing laboratory may be requested to serve as a consultant to the attorneys, the defendant, or the judge. The laboratory also has an obligation to perform quality DNA tests and to interpret and report the results accurately and without bias.

The laboratory should test only the amount of sample needed to obtain reliable test results and retain untested samples for possible future testing.

The public or private laboratory skilled in DNA testing can assist in the post conviction process in a number of ways, including:

- Agreeing to conduct some pro bono testing at the request of a judicial officer, prosecutor, defense counsel, or project.
- Making its personnel available to assist participants in a post conviction preceding who lack adequate technical expertise.
- Victim, reference, and kinship samples are accessioned into the laboratory system and documented by proper chain of custody.
- DNA is extracted and genotyped, and that analysis of the genotype data, including matching and statistics, is performed.
- Samples are reaccessioned and accounted for, if they have been outsourced.

Final administrative review—comparing the DNA results to non-DNA metadata—is conducted and, if necessary, reconciled. [Note: Metadata for a kinship sample, for example, include the kin's name, biological relationship to the victim, and when and where the sample was collected.

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Special attention is required for:

- Sample collection, preservation, shipping, and storage.
- Tracking and chain of custody issues.
- Clean, secure laboratory facilities.
- Quality assurance and quality control practices.
- Managing the work.

- DNA extraction and typing.
- Interpretation of results.
- Automation.
- Use of software for sample tracking and data management.
- Use of an advisory panel of experts.
- Public education and communication.
- Privacy issues.

8.3 Forensic Scientists

The application of forensic DNA evidence is increasingly vital to ensuring accuracy and fairness in the criminal justice system. Access to the latest training, information, and resources for the forensic scientists who work in our Nation's crime laboratories is critical to ensuring the most effective use of this technology.

Tools for Forensic Scientists-

This list of tools and information is provided to aid forensic scientists working in Nation's crime laboratories.

- Standard Reference Materials (NIST)
- Population Data from STR Systems
- Published STR Multiplexes
- List of Three-Banded Allele Patterns
- List of Variant Alleles

8.4 Role of Expert

While interpreting the DNA evidence the expert has to take due care of using his all expertise and experience. He should not undergo mal practice. Give false evidence under any pressure, inducements and any sort of influence.

Cuilibet In Sua Artepertio Est Credendum –Credence Should Be Given To An Expert

Imperitia Culpae Adnumeratur –In Expert Wont Of Skill Is Culpable

- **Availability And Cost of Experts**

Wide use of forensic DNA typing will have considerable costs. Laboratories will be required to be funded by many states and the federal government. The Commonwealth of Virginia, for example, has committed several million dollars to its DNA forensic activities. Costs will be associated with upgrading the databanks when new procedures replace old ones. Increased costs will also be associated with the control, licensing, and oversight of laboratories and technicians. Many experts will need to be available. The defense cost will be substantially increased. Moreover, as DNA typing becomes more generally available, jurors might expect it in situations where it is impossible to produce. A failure to introduce DNA typing evidence could lead to an inference of spoliation, i.e., the destruction or alteration of evidence.

Of course, the early exclusion of suspects who have been cleared by DNA typing evidence will reduce other costs to the judicial system. DNA evidence might also obviate trials in some cases by proving identity fairly conclusively. In general, however, the costs of the criminal-justice system will be increased.

We cannot now accurately estimate the cost of the widespread use of DNA typing, but it can be expected to run into the tens of millions of dollars a year. However, relative to the cost of operating the entire system, the cost of using DNA evidence is minuscule. The quality of justice will be increased by full use of DNA typing. In general, we believe that the expenditures are warranted by the advantages to be expected.

8.5 Researchers

Forensic DNA has played a crucial role in the investigation and resolution of thousands of crimes. The demand for tools and technologies for DNA testing far exceeds the current capabilities of the field. The forensic DNA community would greatly benefit from technical tools and innovations that can be appropriately validated, quality-controlled, quality-assured, and implemented for forensic use.

8.6 Officers and Investigator

DNA technology is enabling cases to be solved previously thought unsolvable. Investigators with a fundamental knowledge of how to identify, preserve, and collect DNA evidence properly can solve cases in ways previously seen only on television. Evidence invisible to the naked eye can be the key to solving a residential burglary or child's murder. It also can link different crime scenes to each other in a small town, within a single State, or across the Nation.

Chain of Custody

The chain of custody of evidence is a record of individuals who have had physical possession of the evidence. Documentation is critical to maintaining the integrity of the chain of custody. Maintaining the chain of custody is vital for any type of evidence. In addition, if laboratory analysis reveals that DNA evidence was contaminated, it may be necessary to identify persons who have handled that evidence.

In processing the evidence, the fewer people handling the evidence, the better. There is less chance of contamination and a shorter chain of custody for court admissibility hearings. Because extremely small samples of DNA can be used as evidence, greater attention to contamination issues is necessary when identifying, collecting, and preserving DNA evidence. DNA evidence can be contaminated when DNA from another source gets mixed with DNA relevant to the case.

8.7 role/duties of judges Crime Scene Integrity-Duty of Investigating Agency

Boni Judicis Est Judiciam Sine Diletione Manclare Excecutioni- A Good Judge Should Have A Judgement Without Delay

Boni Judicis Est Lites Crilimare Ne Lix Ex Lite Oriture, Et Interest Reipublicae Ut Sini Fines Litium- A Good Judgeshould Put On End To Litigation That Suit May Not Grow Out Of A Suit As It Concern The Welfare Of State

Judicias EST Jus Decere Non-Dare – the Judge's Duty Is to Decide according To the Allegation and Proof.

Protection of the crime scene is essential to the protection of evidence[333]. Safeguarding and preserving evidence is fundamental to the successful solution of a crime. Remember, while documenting evidence at the crime scene, to include descriptions of whether evidence was found wet or dry. An example of this documentation would include blood spatters.

The risk of contamination of any crime scene can be reduced by limiting incidental activity. It is important for all law enforcement personnel at the crime scene to make a conscious effort to refrain from smoking, eating, drinking, littering or any other actions which could compromise the crime scene. Because DNA evidence is more sensitive than other types of evidence, law enforcement personnel should be especially aware of their actions at the scene to prevent inadvertent contamination of evidence.

When probability statements are admissible, the judge should not be expected to instruct the jury in detail on probabilities is computed or how probabilities available from an analysis of DNA material should be combined with probability estimates based on more traditional testimony and other evidence. Those matters are better left to the experts and to the lawyers on summation. The court should encourage the use of charts, written reports, and duplicates of materials that are relied on by the experts, so that the jury can be as well educated as possible in the evaluation of DNA typing evidence. To that end, the court should insist that technical terms be reduced to understandable lay language and that scientific information be presented to the jury in the least confusing form possible.

DNA typing may be assessed within the framework of normal forensic laboratory work and can be readily handled with the present rules and forms of charges.

Judges may feel compelled to take a proactive stance to protect the inmate seeking relief if the prosecution and defence are refusing to cooperate. A court may be especially likely to exercise its discretion in the interests of justice in a potential category 1 case, particularly if the court fears that the passage of time may make it impossible to ascertain the validity of a claim of actual innocence.

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[333]See, Article, "Advancing Justice through DNA Technology", available at http://www.dna.gov/basics/evidence_collection/crime-scene-integrity and see also http://www.forensicmag.com/tips-sub/1006 (Last visited on 7th July 2010)

The judge's assistance may be sought in connection with such matters as locating and preserving evidence, obtaining discovery from laboratories, and compelling third parties to provide samples for elimination testing. The court might also consider whether to exercise its discretion to appoint an expert to assist the court in a case that presents disputed, complex, technical issues relating to DNA testing or interpretation.

- Trial courts will likely be involved in category 1 and category cases. By issuing orders, the court can play an important role in helping obtain access to evidence prior to testing, which is part of the screening process and helps determine if DNA evidence will be irrelevant to the case.

In the retesting stage, it is recommended that the court set an informal conference with counsel to discuss issues such as the type of DNA analysis to be used, whether it will be necessary to test the victim's relatives or third parties, and whether additional samples need to be obtained from the vitim. Once post conviction DNA test results have been obtained, if the results are favorable to the inmate and no alternative explanations exist, the court should be prepared to grant a joint request to vacate the conviction. In the absence of a joint motion, an evidentiary hearing should be set to determine if there is a reasonable probability of a change in the verdict or judgment of conviction.

8.8 Law Enforcement and Officers of the Court:

Cooperation on the part of law enforcement officials may be crucial; materials needed for testing or retesting may be in their possession.

Consequently, they can assist in:

- Finding the evidence that was sent to the laboratory for testing.
- Identifying and locating other evidence that is now testable.
- Preserving the evidence.

DNA has become an invaluable instrument in the search for justice. DNA evidence may play a significant role at various points throughout the life of a criminal case, from the initiation of a criminal investigation through post-conviction confirmation of

the truth. As the "end users" of DNA evidence, Officers of the Court must understand both the science and technology of DNA evidence.

8.9 Victim's Advocates

DNA evidence is playing a larger role than ever before in criminal cases throughout the country, both to convict the guilty and to exonerate those wrongly accused or convicted. This increased role places greater importance on the ability of victim service providers to understand the potential significance of DNA evidence in their clients' cases.

Role of the Victims' Advocate in Post conviction Testing-

The role of the victims' advocate in postconviction proceedings is essential and complex. The advocate's usual role is to provide support, which will likely be needed during a postconviction proceeding as it may be extremely traumatic for surviving victims and their families to learn that a person found guilty is now attempting to vacate the conviction. The early involvement of victims' advocates lessens the chance of victims and their families making this discovery through the media and ensures that they are kept informed and treated with appropriate concern and respect.

In cases in which biological evidence was collected and still exists—and if the evidence is subjected to DNA testing or retesting, exclusionary results will exonerate the petitioner—advocates may also have to prepare their clients for the possibility that the inmate will be exonerated. If this occurs, advocates face the difficult task of providing support for the person whose misidentification of the culprit may have been the chief evidence leading to the original guilty verdict.

Advocates will at times be called upon to persuade a victim to agree to DNA testing even though the victim is convinced of the accuracy of the identification he or she made at the inmate's trial. For exclusionary purposes, samples may also have to be tested from persons who were engaged in sexual relations with the victim at the relevant time. Victims may be reluctant to provide names or to urge these persons to cooperate. In order to expedite postconviction proceedings, victims' advocates must make victims appreciate the desirability of cooperating because DNA testing

may lead to the apprehension of the person who was truly guilty and prevent future criminal acts.

It is important to note that a number of States passed victims' rights statutes that require notification of victims, including notification of appeals proceedings, prison release, and application for pardon or commutation of sentence. Agencies involved in postconviction DNA cases should make certain they are complying with any applicable State statutes. (See a summary of DNA post conviction statutes prepared by the American Society of Law, Medicine & Ethics.)

It is extremely important that crime victims and their family members are provided with information and approached with great sensitivity regarding postconviction issues. Notification of requests for DNA testing should be made by the prosecutor through a victim assistance specialist.

Avoid unreasonable and intrusive sample collection. Explain technical aspects of testing and the significance of the samples request. Ensure that information about the location of victims and family members remains confidential. Provide information about testing results in a timely fashion, in person if possible.

8.10 The Prosecutor

The prosecutor will work closely with the investigators and will normally have access to adequately staffed and organized forensic laboratories. The prosecutor should carefully supervise the investigation activities to ensure that DNA typing evidence will be admissible, if it proves relevant.

The prosecutor has a strong responsibility to reveal fully to defense counsel and experts retained by the defendant all material that might be necessary in evaluating the evidence. That includes information on tests that proved inconclusive, on retesting, and on the testing of other persons. Adoption of rules or statutes that require the prosecutor to involve the defense in analysis of DNA samples at the earliest possible moment is highly recommended.

The committee recommends going beyond what is required by the federal rules of criminal procedure and of civil procedure in regard to disclosures concerning DNA

evidence. For example, data sheets and other materials obtained from experts who are not designated to testify should be available freely without the need for separate motions, because such materials are important for the evaluation of the scientific evidence in the case of DNA typing. Such free exchange of information, including access to databanks and to samples of evidence DNA, should apply to defense and prosecution experts in both criminal and civil cases.

(a) Recommendations for Prosecutors for Post conviction

Requests for post conviction DNA testing may come from a variety of parties, including inmates, their families, defense attorneys, or police. When a request for post conviction DNA testing is received, recommendations for prosecutors include the following:

- Get as much information as possible about the inmate and the case, including defenses proffered at trial and defenses currently claimed.
- Determine whether the case is suited to DNA testing, depending on the category of the case. Evaluate previous DNA testing.
- Provide information to the requestor, including the fact that DNA testing could have a negative effect if the inmate's DNA testing results are placed in a DNA criminal identification bank and he is identified as a perpetrator of other crimes.
- Throughout the process, consult and notify victim/witness specialists, forensic DNA experts, defense counsel, and prosecutors experienced in DNA technologies and postconviction relief issues.

8.11 The Defense

Defense counsel must have access to adequate expert assistance, even when the admissibility of the results of analytical techniques is not in question, because there is still a need to review the quality of the laboratory work and the interpretation of the results. When the prosecutor proposes to use DNA typing evidence or when it has been used in the investigation of the case, an expert should be routinely available to the defendant. If necessary, he or she should be able to apply for funds early in the

discovery stages to retain experts without a showing of relevance that might reveal trial strategy.

Whenever possible, a portion of the DNA sample should be preserved for independent analysis by the defense[334].

The prosecutor should promptly reveal to defense counsel that DNA was involved in the investigation and might be available for analysis at the trial. Normally, the criminal-justice system will not provide for the appointment of counsel for the defendant or for payment for experts until the defendant has been arrested or charged. Where a sample of the defendant's tissue is sought for DNA typing, application to the court for DNA experts should be possible even before an arrest has been made.

In our judicial system, jurors are relatively independent. Nevertheless, through limitations on the admissibility of evidence and on the form of its presentation and through the use of a variety of instructions, the court exercises considerable influence. DNA evidence, like other scientific and statistical evidence, can pose special problems of jury comprehension. Courts and attorneys should cooperate to facilitate jury understanding. Innovative techniques, such as allowing jurors to take notes or ask questions, might be considered. Jargon should be avoided, and information should be presented simply, clearly, and fairly. Unless limited by law or court rules, judges should be free to pose questions to witnesses when they feel that the answers might clarify the testimony. Reports and relevant materials should be admitted into evidence so that they can be studied by courts at their leisure. Finally, a judge would not be amiss in pointing out to attorneys the wisdom of including jurors who are found to have a background that enhances their ability to understand the expert testimony.

(a) Recommendations for Defense Counsel-

- Perform extensive screening to determine if the case is suited to DNA testing.
- If a case is determined to warrant DNA testing, conduct an extensive search for evidence, consulting with prosecutors throughout the search.

334.See,Paul C. Giannelli, Ake V. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World, *89 Cornell L. Rev. 1305* Available at https://litigationessentials.lexisnexis.com/webcd/app (visited on 3rd November 2010)

- Do not contact the victim. It is up to the prosecutor's office, through its victim services agency, to determine if it is appropriate to inform the victim of testing.

Defense counsel should appreciate that convictions are rarely reopened and that a noncontentious attitude may expedite the location of needed biological samples and accelerate the testing process that is an innocent client's best hope for relief.

On the other hand, defense counsel must also recognize and inform their clients that truth may have a price and that inculpatory results will have to be disclosed to the prosecution. Convicted felons are not entitled to testing without risking the consequences of false claims of innocence.

8.12 Policymakers and Lawmakers

DNA technology is increasingly vital to ensuring accuracy and fairness in the criminal justice system. In order to realize the vast potential of DNA technology, policy and legislation must set a framework that allows for the most effective use of the technology while ensuring privacy and information integrity.

Protective Orders

Protective orders should not be used to prevent experts on either side from obtaining all relevant information, which can include original materials, data sheets, software protocols, and information about unpublished databanks. A protective order might be appropriate to limit disclosures by attorneys and experts to third parties about proprietary information acquired in the course of a particular case; but as a general rule, any scientific information used in a case should be open to widespread scientific scrutiny. One exception might be when the expert is involved in a current or recently completed study on which he or she does *not* directly rely to develop an opinion. That will ensure that the expert does not lose his or her opportunity to publish as a consequence of testifying. Protective orders to prevent unnecessary intrusion into the privacy of such persons as those who have been cleared after investigation or who are juveniles are appropriate

8.13 Data Bank Related Conclusion-Suggestions

- In principle, a national DNA profile databank should be created that contains information on felons convicted of violent crimes with high rates of recidivism. The case is strongest for felons who have committed rape, because perpetrators typically leave biological evidence (semen) that could allow them to be identified. The case is somewhat weaker for violent offenders who are most likely to commit homicide as a recidivist offense, because killers leave biological evidence only in a minority of cases. The wisdom of including other offenders depends primarily on the rate at which they are likely to commit rape, because rape is the crime for which the databank will be of primary use.
- There are a number of scenarios that illustrate the point that the databank need not be limited to persons convicted of specified crimes.
- The databank should also contain DNA profiles of samples from unidentified persons collected at the scenes of violent crimes.
- Databanks containing DNA profiles of members of the general population (as exist for ordinary fingerprints for identification purposes) are not appropriate, for reasons of both privacy and economics.
- DNA profile databanks should be accessible only to legally authorized persons and should be stored in a secure information resource.
- Legal policy concerning access and use of both DNA samples and DNA databank information should be established before widespread proliferation of samples and information repositories. Interim protection and sanctions against misuse and abuse of information derived from DNA typing should be established immediately. Policies should explicitly define authorized uses and should provide for criminal penalties for abuses.
- Although the committee endorses the concept of a limited national DNA profile databank, we doubt that existing RFLP-based technology provides a wise long-term foundation for such a databank. We expect current methods to be replaced soon with techniques that are simpler, easier to automate, and less expensive—but incompatible with existing DNA profiles. Accordingly, we do not recommend establishing a comprehensive DNA profile databank yet.
- For the short term, we recommend the establishment of pilot projects that involve prototype databanks based on RFLP technology and consisting

primarily of profiles of violent sex offenders. Such pilot projects could be worthwhile for identifying problems and issues in the creation of databanks. However, in the intermediate term, more efficient methods will replace the current one, and the forensic community should not allow itself to become locked into an outdated method.

- State and federal laboratories, which have a long tradition and much experience with the management of other types of basic evidence, should be given primary responsibility, authority, and additional resources to handle forensic DNA testing and all the associated sample-handling and data-handling requirements.
- Private-sector firms should not be discouraged from continuing to prepare and analyze DNA samples for specific cases or for databank samples, but they must be held accountable for misuse and abuse to the same extent as government-funded laboratories and government authorities.
- Discovery of a match between an evidence sample and a databank entry should be used only as the basis for further testing using markers at additional loci. The initial match should be used as probable cause to obtain a blood sample from the suspect, but only the statistical frequency associated with the additional loci should be presented at trial.

8.14 Other Suggestions Recommendations

(a) Eliminating Backlogs

One of the biggest problems facing the criminal justice system today is the substantial backlog of unanalyzed DNA samples and biological evidence from crime scenes, especially in sexual assault and murder cases. Too often, crime scene samples wait unanalyzed in police or crime lab storage facilities. Timely analysis of these samples and placement into DNA databases can avert tragic results.

(b) Effect of Clearing the Backlog

The results of addressing backlogs are dramatic, as the two examples below illustrate:

Several law enforcement agencies, prosecutors' offices, and crime labs across the country have established innovative programs to review old cases. Often called "cold case units," these programs have enabled criminal justice officials to solve cases that have languished for years without suspects. Most frequently, DNA evidence has been the linchpin in solving these cases

(c) Strengthening Crime Laboratory Capacity

At present, many of our Nation's crime laboratories do not have the capacity necessary to analyze DNA samples in a timely fashion. Many have limited equipment resources, outdated information systems, and overwhelming case management demands. As a result, the criminal justice system as a whole is unable to reap the full benefits of DNA technology. The President's initiative will provide federal funding to further automate and improve the infrastructure of federal, state, and local crime labs so they can process DNA samples efficiently and cost-effectively. These infrastructure improvements are critical to preventing future DNA backlogs, and to helping the criminal justice system realize the full potential of DNA technology.

(d) Increasing the Analysis Capacity of Public Crime Labs

The labs can update their infrastructure, automate their DNA analysis procedures, and improve their retention and storage of forensic evidence[335].

- Providing Basic Infrastructure Support: Some public crime laboratories still need assistance to help them obtain equipment and material to conduct the basic processes of DNA analysis – extraction, quantitation, amplification and analysis – and to help them meet various accreditation requirements.
- Building Infrastructure through Laboratory Information Management Systems: Laboratory Information Management Systems, or "LIMS," are designed to automate evidence handling and casework management, to improve the integrity and speed of evidence handling procedures, and to ensure proper chain of custody. DOJ estimates that only 10 percent of the public DNA laboratories have LIMS systems.

[335] http://www.justice.gov/ag/dnapolicybook_solve_crimes.htm (visited on 4th December 2010)

- Providing Automation Tools to Public DNA Laboratories: To streamline aspects of the DNA analysis procedure that are labor and time-intensive, crime laboratories should have automated systems, such as robotic DNA extraction units. Automated DNA analysis systems increase analyst productivity, limit human error and reduce contamination.
- Providing Support for the Retention and Storage of Forensic Evidence: Forensic evidence must be stored in a manner that ensures its integrity and maintains its availability throughout criminal investigations and judicial proceedings. Appropriate evidence storage conditions require costly equipment such as security systems, environmental control systems, ambient temperature monitors, and de-humidifiers. The initiative will support the improvement of evidence storage capabilities.

(e) Funding the Forensic Analysis Programs

The Laboratory runs several different programs for the analysis of DNA information. The Nuclear DNA Program supports central, state, local, and international law enforcement agencies by providing advanced technical assistance within the forensic biology discipline and sub-disciplines through interrelated capabilities and expertise. Mitochondrial DNA is a powerful tool available for investigating cases of kidnapping, missing persons, and skeletal remains where nuclear DNA is not present.

(f) Stimulating Research and Development

In order to improve the use of DNA technology to advance the cause of justice, the Attorney General will stimulate research and development of new methods of analyzing DNA samples under the President's initiative. Also, the President has asked the Attorney General to establish demonstration projects under the initiative to further study the public safety and law enforcement benefits of fully integrating the use of DNA technology to solve crimes. Finally, the President has directed the Attorney General to create a National Forensic Science Commission to study rapidly evolving advances in all areas of the forensic sciences and to make recommendations to maximize the use of the forensic sciences in the criminal justice system. In all, the President's initiative will devote $24.8 million in FY 2004 to fund advances in the use of DNA technology.

(g) Improving DNA Technology

Forensic DNA analysis is rapidly evolving. Research and development of tools that will permit crime laboratories to conduct DNA analysis quickly is vital to the goal of improving the timely analysis of DNA samples. Smaller, faster, and less costly analysis tools will reduce capital investments for crime laboratories while increasing their capacity to process more cases. Over the course of the next several years, DNA research efforts will focus on the following areas:

- The development of "DNA chip technology" that uses nanotechnology to improve both speed and resolution of DNA evidence analysis. This technology will reduce analysis time from several hours to several minutes and provide cost-effective miniaturized components.
- The development of more robust methods to enable more crime labs to have greater success in the analysis of degraded, old, or compromised items of biological evidence.
- Advanced applications of various DNA analysis methods, such as automated Short Tandem Repeats (STRs), Single Nucleotide Polymorphisms (SNPs), mitochondrial DNA analysis (mtDNA), and Y-chromosome DNA analysis.
- The use of animal, plant, and microbial DNA to provide leads that may link DNA found on or near human perpetrators or victims to the actual perpetrator of the crime.
- Technologies that will enable DNA identification of vast numbers of samples occasioned by a mass disaster or mass fatality incident.
- Technologies that permit better separation of minute traces of male sexual assailant DNA from female victims.

(h) Establishing DNA Demonstration Projects

To further research the impact of increased DNA evidence collection on public safety and law enforcement operations, the Attorney General will conduct rigorous scientific research through demonstration projects on the use of DNA evidence under the initiative. This research will help determine the scope of public safety benefits that result when police are trained to more effectively collect DNA evidence and

prosecutors are provided with training to enhance their ability to present this evidence in court.

Several jurisdictions will be selected to incorporate core training and evidence collection requirements in their daily operations. At each site, one or more law enforcement agencies will be chosen to implement extensive training on the collection of DNA evidence and to increase the resources devoted to the investigation and prosecution of these cases. Prosecutors will also receive training on how to more effectively present DNA evidence and how forensic DNA technology may be used to solve current and "cold" cases. Jurisdictions that received increased training and resources will be compared with jurisdictions that did not receive these benefits.

The resulting comparison will measure the impact of increased DNA evidence collection on public safety and law enforcement operations. For example, projects will examine whether there are increased crime clearance rates, whether DNA aided investigations, the number of cases successfully prosecuted, the number of cases where guilty pleas were obtained due to the presence of DNA evidence, any financial savings resulting from the use of forensic evidence, and increased responsiveness to victims. The information obtained will allow state and local governments to make more informed decisions regarding investment in forensic DNA as a crime-fighting tool.

(i) Creating a National Forensic Science Commission

To facilitate the ability of policymakers to assess the needs of the forensic science community, and to stimulate public awareness of the uses of forensic technology to solve crimes, the President has directed the Attorney General to create a National Forensic Science Commission. The Commission will be charged with two primary responsibilities: (1) developing recommendations for long-term strategies to maximize the use of current forensic technologies to solve crimes and protect the public, and (2) identifying potential scientific breakthroughs that may be used to assist law enforcement.

The Attorney General will appoint Commission members from professional forensic science organizations and accreditation bodies and from the criminal justice

community. These individuals will have broad knowledge and in-depth expertise in the criminal justice system and in various areas of the forensic sciences such as analytical toxicology, trace evidence, forensic biology, firearms and toolmark examinations, latent fingerprints, crime scene analysis, digital evidence, and forensic pathology, in addition to DNA. Judges, prosecutors, attorneys, victim advocates, and other members of the criminal justice system will also be represented on the Commission.

The Commission will study advances in all areas of the forensic sciences and make recommendations on how new and existing technologies can be used to improve public safety. The Commission will also serve as an ongoing forum for discussing initiatives and policy, and may issue recommendations that will assist state and local law enforcement agencies in the cost-effective use of these technologies to solve crimes.

8.15 Training to various agencies

(a) Training the Criminal Justice Community

In order to maximize the use of DNA technology, under the President's initiative, the Attorney General will develop training and provide assistance regarding the collection and use of DNA evidence to the wide variety of professionals involved in the criminal justice system, including police officers, prosecutors, defense attorneys, judges, forensic scientists, medical personnel, victim service providers, corrections officers, and probation and parole officers.

Key players in the criminal justice system should receive additional training in the proper collection, preservation, and use of DNA evidence. Fundamental knowledge of the capabilities of DNA technology is essential for police officers to collect evidence properly, prosecutors and defense attorneys to introduce and use it successfully in court, and judges to rule correctly on its admissibility. Victim service providers and medical personnel likewise need to understand DNA technology in order to encourage more successful evidence collection and to be fully responsive to the needs of victims.

(b) Law Enforcement Training

As the first responders to crime scenes, law enforcement officers should be able to identify, collect and preserve probative biological evidence for submission to crime laboratories. Improper collection can mean that valuable evidence is missed or rendered unsuitable for testing. The initiative devotes $3.5 million in FY 2004 to assist law enforcement in meeting the following training needs:

- Basic "awareness training" on DNA evidence for patrol officers and other first-responders;
- Intensive training on identifying, collecting, and preserving potential DNA evidence for evidence technicians, investigators, and others processing crime scenes;
- Training and education for investigators and responding officers on DNA databases and their potential to provide leads in current and "cold" cases; and
- Training and information for law enforcement leadership and policymakers to facilitate more informed decisions about effective DNA evidence collection and testing.

(c) Training Prosecutors, Defense Attorneys, and Judges

In order to achieve just results in cases involving DNA evidence, prosecutors, defense attorneys, and judges should receive proper training on the use and presentation of DNA evidence. The initiative devotes $2.5 million in FY 2004 to support:

- Training and technical assistance for prosecutors to learn about solving "cold cases" with DNA evidence, responding to post-conviction DNA testing requests, and developing innovative legal strategies to optimize the power of forensic DNA technology. Grant funds will be available for state and local prosecutors' organizations for the development and delivery of training materials to assist prosecutors in presenting this evidence before courts and juries, and in understanding more about the value of DNA evidence in particular cases.
- Training for defence counsel handling cases involving biological evidence on the applications and limitations of DNA evidence. Grant funds will be made

available to continuing legal education programs or bar associations to provide training and resources on forensic DNA technology.

- Training for judges, who must be equipped with sufficient technical and scientific knowledge to make appropriate rulings in cases involving DNA evidence. Grant funds will be available to national judicial conferences and organizations.

(d) Training for Probation and Parole Officers and Corrections Personnel

Probation and parole officers play a critical role in ensuring that offenders are complying with their statutory obligations to provide DNA samples. Corrections personnel often are responsible for obtaining DNA samples from inmates required by law to submit such samples. Through training and education programs, these professionals will be better equipped to ensure that samples are taken from all individuals who are required by law to provide them. The initiative calls for $1 million in FY 2004 to support this training.

(e) Training for Forensic Scientists

The forensic science community has a critical need for trained forensic scientists in public crime laboratories. The initiative will assist the development of comprehensive training programs for a new generation of forensic scientists, enabling new forensic scientists to receive in-depth training to prepare them for analyzing actual casework in a crime laboratory. The initiative calls for $3 million in FY 2004 to support this training.

(f) Training for Medical Personnel

The initiative will also provide $5 million in FY 2004 to support the development of training and educational materials for doctors and nurses involved in treating victims of sexual assault. Trained medical personnel are needed to effectively collect usable DNA evidence, while safeguarding the privacy rights and addressing the needs of rape victims requiring sexual assault exams. These programs will specifically target underserved areas of the country. Funding may also be used to support the

development of SANE (Sexual Assault Nurse Examiner), SAFE (Sexual Assault Forensic Examiner), and SART (Sexual Assault Response Team) programs.

(g) Training for Victim Service Providers

Victims and those who advocate on their behalf must have access to information about the investigative and courtroom uses of forensic DNA evidence. Victims should be properly informed about how DNA evidence may impact their cases. In situations involving post-conviction DNA testing, victim service providers must be able to assist victims through the often-painful process of newly-ordered DNA tests and re-opened court proceedings. To address the concerns of victims, the initiative would develop additional DNA education and training programs for victim advocates and victim service providers so that they may better assist victims in all cases involving DNA evidence.

8.16 Accountability and Public Scrutiny-

Because the application of DNA typing in forensic science is to be used in the service of justice, it is especially important for society to establish mechanisms for accountability and to ensure appropriate public scrutiny.

Accountability must be an issue in proficiency testing and accreditation. There is reason to be skeptical of entrusting any important regulatory matters to a self-regulating organization. Accordingly, any organization conducting accreditation or regulation of DNA technology for forensic purposes should be free of influence of private companies, public laboratories, or other organizations actually engaged in laboratory work.

Private laboratories used for testing should not be permitted to withhold information from defendants on the grounds that "trade secrets" are involved. Alternatively, law-enforcement agencies could use only public laboratories for testing, so that the issue of "trade secrets" would not arise. Critics of DNA testing have suggested that the profit motive of private testing companies undermines their reliability. Although that criticism might be justified when companies are eager to market a product before it is ready, no general indictment of private companies on this basis is justified.

Testing methods and data need to be made available for public scrutiny. There has been a notable dearth of published research in forensic DNA testing by scientists unconnected to the companies that market the tests. In contrast with the research approach whereby new drugs and biomedical devices undergo controlled trials of safety and efficacy, forensic science has used more informal modes of evaluating new techniques. The process of peer review used to assess advances in biomedical science and technology should be used for forensic DNA technology.

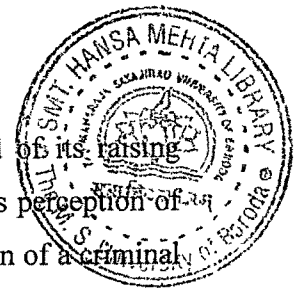
Whether in publications or in court, companies might be reluctant to reveal their specific testing methods or the population data used to determine the probability of a match, because they consider this information to constitute a trade secret that could be exploited by competitors. However, the integrity of the scientific method and judicial due process demand that such information be revealed, particularly in criminal cases. The scientific community should require that the same standards used to assess new findings in other sectors of science be applied to DNA typing in the forensic setting.

8.17 Expectations

The introduction of a powerful new technology is likely to set up unwarranted or unrealistic expectations. Various expectations regarding DNA typing technology are likely to be raised in the minds of jurors and others in the forensic

For example, public perception of the accuracy and efficacy of DNA typing might well put pressure on prosecutors to obtain DNA evidence whenever appropriate samples are available. As the use of the technology becomes widely publicized, juries will come to expect it, just as they now expect fingerprint evidence, surveillance photographs, and audio and visual eavesdropping. Moreover, prosecutors will not want to give defense attorneys the opportunity to ask on summation, "If my client was the perpetrator, where is the DNA evidence?"

Once a prosecutor produces DNA evidence, the defense will be under great pressure to undermine it through the use of reports and experts, because of an assumption that the jury would interpret a failure to call a defense expert as an admission that the DNA evidence is persuasive. Mere cross examination by



Two aspects of DNA typing technology contribute to the likelihood of its raising inappropriate expectations in the minds of jurors. The first is the jury's perception of an extraordinarily high probability of enabling a definitive identification of a criminal suspect; the second is the scientific complexity of the technology, which results in laypersons' inadequate understanding of its capabilities and failings. Taken together, those two aspects can lead to the jury's ignoring other evidence that it should be considering.

Expectations regarding the power of DNA typing can lead to overlooking or ignoring sources of error or mistakes in applying the technology. For example, jurors' focusing on the probability of correctly identifying a per-

Perpetor might lead them to discount the possibility of laboratory error, whether it stems from incompetence or carelessness of personnel, malfunctioning equipment, or unavoidable mistakes.

The efficacy and accuracy of a new technology typically are initially demonstrated by the most highly competent and knowledgeable practitioners. As DNA typing becomes routine, the quality of laboratories and personnel using it might decrease while still meeting the standards required for accreditation or licensing. However, the expectations of judges and juries might remain high, because of the superior knowledge and competence of the initiators of the technology. Later gains in experience and improved typing could lead to an increase in quality.

As large felon databanks are created, the forensic community could well place more reliance on DNA evidence, and a possible consequence is the underplaying of other forensic evidence. Unwarranted expectations about the power of DNA technology might result in the exclusion of relevant evidence.

Both prosecutors and defense counsel are entitled to benefit from the power of DNA evidence, but they should not oversell it. DNA evidence is not infallible; all laboratory work is subject to error; and, given current population databanks and laboratory protocols, a witness or prosecutor will seldom (if ever) be justified in stating that the probability that a reported DNA match involves someone other than the suspect is so low as to make that possibility entirely implausible. Claims that treat

DNA identifications as though they are as reliable as fingerprint identifications in the typical rape or murder case are unjustified; until technology and databanks improve, they are likely to remain so.

Presentations suggesting to a judge that DNA typing is infallible can rarely be justified and should generally be avoided. However, there might be instances where a prosecutor could legitimately argue that the DNA evidence conclusively proves that the defendant committed the offense. Two examples are illustrative:

- The victim is confined to an institution where access is limited to relatively few male attendants. Semen taken from the vagina is subjected to analysis and compared to blood samples from all possible males with access to the victim. The defendant's known sample is the only profile that matches the evidentiary sample. In this circumstance, the prosecutor could well argue that only the defendant could have committed the crime.
- In a prosecution for sexual assault of a child, again a limited number of people might have access to the child, with only one possible donor matching the evidentiary sample. Again, the prosecutor might argue that the DNA evidence is conclusive.

8.18 International Exchange-

The need for international cooperation in law enforcement calls for appropriate scientific and technical exchange among nations. As in other areas of science and technology, dissemination of information about DNA

Typing and training programs for personnel likely to use the technology should be encouraged. It is desirable that all nations that will collaborate in law-enforcement activities have similar standards and practices, so efforts should be furthered to exchange scientific knowledge and expertise regarding DNA technology in forensic science[336].

[336] See, DNA Technology in Forensic Science, National Academic Press, Available at http://www.nap.edu/openbook.php?record (visited on 2nd January 2011)

8.19 Universal Declaration on the Human Genome and Human Rights, 1997.

(a) The Universal declaration on the Human Genome and Human Rights, adopted unanimously and by acclamation by the General Conference of UNESCO at its 29th session on 11 November 1997, is the first universal instrument in the field of biology. The uncontested merit of this text resides in the balance it strikes between safeguarding respect for human rights and fundamental freedoms and the need to ensure freedom of research. The moral commitment entered into by States in adopting the Universal Declaration on the Human Genome and Human Rights is a starting point, the beginning of international awareness of the need for ethical issues to be addressed in science and technology, and it is now upto States, through the measures they decide to adopt, to put the Declaration into practice and thus ensure its continued existence.

(b) The Declaration is without prejudice to the international instruments, which could have a bearing on the applications of genetics in the field of intellectual property. The Declaration recognizes that research on the human genome and the resulting applications open up vast prospects for progress in improving the health of individuals and of humankind as a whole, emphasizing that such research should fully respect human dignity, freedom and human rights, as well as the prohibition of all forms of discrimination based on genetic characteristics.

(c) Articles 1 to 4 emphasize the importance of human dignity and it is declared that human genome underlies the fundamental unity of all members of the human family, as well as the recognition of their inherent dignity and diversity, which in a symbolic sense is the heritage of humanity. Everyone has a right to respect for their dignity and for their rights regardless of their genetic characteristics. Human dignity makes it imperative not to reduce individuals to their genetic characteristics and to respect their uniqueness and diversity. It is declared that the human genome which by its nature evolves is subject to mutations and contains potentialities that are expressed differently according to each individual's natural and social environment including the individual's state of health, living conditions, nutrition and education. It is further declared that human genome in its natural state shall not give rise to financial gains.

(d) Part B of the Declaration, in Articles 5 to 9, deals with the rights of persons concerned. Article 5 provides that research treatment or diagnosis affecting an individual's genome shall be undertaken only after rigorous and prior assessment of the potential risks and benefits pertaining thereto and in accordance with any other requirement of national law, and further provides that, in all cases, the prior, free and informed consent of the person concerned shall be obtained. If such person is not in a position to consent, consent or authorization shall be obtained in the manner prescribed by law, guided by the person's best interest. Right of each individual to decide whether or not to be informed of the results of genetic examination and its consequences should be respected. If a person does not have the legal capacity to consent, research affecting such person's genome may only be carried out for direct health benefit of such person subject to the authorization and the protective conditions prescribed by law. Article 6 shuns discrimination based on genetic characteristics that has the effect of infringing human rights, human dignity and fundamental freedoms. Genetic data associated with identifiable person and stored or processed for the purposes of research or any other purpose is required to be held confidential in the conditions set by law. Every individual shall have the right, according to international and national law[337], to just reparation for any damage sustained as a direct and determining result of an intervention affecting his or her genome. In order to protect human rights and fundamental freedoms, limitations to the principles of consent and confidentiality may only be prescribed by law, for compelling reasons within the bounds of public international law and the international law of human rights.

(e) Articles 10, 11 and 12 deal with research on the human genome and provide that, no research or research application concerning the human genome, in particular, in the fields of biology, genetics and medicine, should prevail over respect for the human rights, fundamental freedoms and the human dignity of individuals or, where applicable, of groups of people. Practices which are contrary to human dignity, such as, re-productive cloning of human beings shall not be permitted, as declared by Article 11, which exhorts States and competent international organization to cooperate in identifying such practices and in taking, at national or international level,

[337]See, Universal Declaration on the Human Genome and Human Rights office of the United Nations High Commissioner for Human Rights, Available at http://www2.ohchr.org/english/law/genome.htm (visited on 25th January 2011)

the measures necessary to ensure that the principles set out in the Declaration are respected. Benefits from advances in biology, genetics and medicines concerning the human genome, are required to be made available to all, with due regard for the dignity and human rights of each individual. Freedom of research, which is necessary for the progress of knowledge, is considered to be a part of freedom of thought. The applications of research, including the applications in biology, genetics and medicines, concerning the human genome, shall seek to offer relief from suffering and improve the health of individuals and humankind as a whole, as declared in Article 12(b).

(f) Articles 13 to 16 are grouped under the head "Conditions for the exercise of scientific activity", highlighting responsibility inherent in the activities of researchers, including meticulousness, caution, intellectual honesty and integrity in carrying out their research on the human genome because of its ethical and social implications. The provisions require the States to take appropriate measures to foster the intellectual and material conditions favorable to freedom in the conduct of research on the human genome and to consider the ethical, legal, social and economic implications of such research, on the basis of the principles set out in this Declaration and expects the States to ensure that research results are not used for non-peaceful purposes. The establishment of ethics committees to assess ethical, legal and social issues raised by research on human genome and its application are to merit the attention of the States.

(g) Articles 17 to 19 lay emphasis on solidarity and international cooperation towards individuals, families and sections in the world's population vulnerable to disease or disability of a genetic character and fostering scientific and cultural cooperation between industrialized and developing countries.

h) For promotion of the principles set out in the Declaration, Article 20 makes it obligatory on the States to take appropriate measures to promote the principles through education and relevant means, inter alia, to the conduct of research and training in inter-disciplinary fields and through the promotion of education in bioethics, at all levels, in particular for those responsible for science policies. Article 21 provides that the States should take appropriate measures to encourage other forms of research, training, and information dissemination conducive to raising the awareness of society and all of its members of their responsibilities regarding the

fundamental issues relating to the defence of human dignity which may be raised by research in biology, in genetics and in medicine, and its applications. They should undertake to facilitate on this subject an open international discussion, ensuring the free expression of various socio-cultural, religious and philosophical opinions. The States are expected to take appropriate measures to promote through education, training and information dissemination, respect for the principles set out in the Declaration and the International Bioethics Committee of the UNESCO is also expected to contribute to the dissemination of these principles, under Articles 23 and 24.

Conclusion

- DNA technology is increasingly vital to ensuring accuracy and fairness in the criminal justice system. DNA can be used to identify criminals with incredible accuracy when biological evidence exists, and DNA can be used to clear suspects and exonerate persons mistakenly accused or convicted of crimes.
- The Initiative calls for increased funding, training, and assistance — to Federal, State, and local forensic labs; to police; to medical professionals; to victim service providers; and to prosecutors, defense lawyers, and judges— ensure that this technology reaches its full potential to solve crimes, protect the innocent, and identify missing persons. This Initiative has the following specific goals:
- Eliminate the current backlog of unanalyzed DNA samples and biological evidence for the most serious violent offenses — rapes, murders, and kidnappings—and for convicted offender samples needing testing.
- Improve crime laboratories' capacities to analyze DNA samples in a timely fashion.
- Stimulate research and develop new DNA technologies and advances in all forensic sciences areas.
- Develop training and provide assistance about the collection and use of DNA evidence to a wide variety of criminal justice professionals.
- Provide access to appropriate post conviction DNA testing of crime scene evidence not tested at the time of trial.

- Ensure that DNA forensic technology is used to its full potential to solve missing persons cases and identify human remains.
- In the forensic context as in the medical setting, DNA information is personal, and a person's privacy and need for confidentiality should be respected.
- The release of DNA information on a criminal population without the subjects' permission for purposes other than law enforcement should be considered.
- Misuse of the information, and legal sanctions should be established to deter the unauthorized dissemination or procurement of DNA information that was obtained for forensic purposes.
- Prosecutors and defense counsel should not oversell DNA evidence. Presentations that suggest to a judge or jury that DNA typing is infallible are rarely justified and should be avoided.
- Mechanisms should be established to ensure the accountability of laboratories and personnel involved in DNA typing and to make appropriate public scrutiny possible.
- Organizations that conduct accreditation or regulation of DNA technology for forensic purposes should not be subject to the influence of private companies, public laboratories, or other organizations actually engaged in laboratory work.
- Private laboratories used for testing should not be permitted to withhold information from defendants on the grounds that trade secrets are involved.
- The same standards and peer-review processes used to evaluate advances in biomedical science and technology should be used to evaluate forensic DNA methods and techniques.
- Efforts at international cooperation should be furthered to ensure uniform international standards and the fullest possible exchange of scientific knowledge and technical expertise.
- In the forensic context as in the medical setting, DNA information is personal, and a person's privacy and need for confidentiality should be respected.
- The release of DNA information on a criminal population without the subjects' permission for purposes other than law enforcement should be considered a misuse of the information, and legal sanctions should be established to deter

the unauthorized dissemination or procurement of DNA information that was obtained for forensic purposes.

- Prosecutors and defense counsel should not oversell DNA evidence. Presentations that suggest to a judge or jury that DNA typing is infallible are rarely justified and should be avoided.
- Mechanisms should be established to ensure accountability of laboratories and personnel involved in DNA typing and to make appropriate public scrutiny possible.
- Organizations that conduct accreditation or regulation of DNA technology for forensic purposes should not be subject to the influence of private companies, public laboratories, or other organizations actually engaged in laboratory work.
- Private laboratories used for testing should not be permitted to withhold information from defendants on the grounds that trade secrets are involved.
- The same standards and peer-review processes used to evaluate advances in biomedical science and technology should be used to evaluate forensic DNA methods and techniques.
- Efforts at international cooperation should be furthered, in order to ensure uniform international standards and the fullest possible exchange of scientific knowledge and technical expertise.
- Courts should take judicial notice of three scientific underpinnings of DNA typing
- The study of DNA polymorphisms can, in principle, provide a reliable method for comparing samples.
- Each person's DNA is unique (with the exception of identical twins), although the actual discriminatory power of any particular DNA test will depend on the sites of DNA variation examined.
- The current laboratory procedure for detecting DNA variation (specifically, single-locus probes analyzed on Southern blots without evidence of band shifting) is fundamentally sound, although the validity of any particular implementation of the basic procedure will depend on proper characterization of the reproducibility of the system (e.g., measurement variation) and the inclusion of all necessary scientific controls.

- The adequacy of the method used to acquire and analyze samples in a given case bears on the admissibility of the evidence and should, unless stipulated, be adjudicated case by case. In this adjudication, the accreditation and certification status of the laboratory performing the analysis should be taken into account.
- Because of the potential power of DNA evidence, authorities must make funds available to pay for expert witnesses, and the appropriate parties must be informed of the use of DNA evidence as soon as possible.
- DNA samples (and evidence likely to contain DNA) should be preserved whenever that is possible.
- All data and laboratory records generated by analysis of DNA samples should be made freely available to all parties. Such access is essential for evaluating the analysis.
- Protective orders should be used only to protect the privacy of the persons involved.
- DNA Technology has many dimensions and has scope of development in science, law society. The technology has impact on almost all aspects of life, society, science, law, religion and morality.
- There is a need to utilize this technology at its optimum level by eliminating all negative out come of the use of the technique by applying suitable legislations for the welfare of the state and public interest.