Chapter-III

Historical Development and Evolution of DNA Technology – Religious & Ethical Perspectives

1. History of Forensic DNA Analysis

1.1 Introduction:

DNA typing, since it was introduced in the mid-1980s, has revolutionized forensic science and the ability of law enforcement to match perpetrators with crime scenes. Thousands of cases have been closed and innocent suspects freed with guilty ones punished because of the power of a silent biological witness at the crime scene.

'DNA fingerprinting' or DNA typing (profiling) as it is now known, was first described in 1985 by an English geneticist named Alec Jeffreys. Dr. Jeffreys found that certain regions of DNA contained DNA sequences that were repeated over and over again next to each other. He also discovered that the number of repeated sections present in a sample could differ from individual to individual. By developing a technique to examine the length variation of these DNA repeat sequences, Dr. Jeffreys created the ability to perform human identity tests.

These DNA repeat regions became known as VNTRs, which stands for variable number of tandem repeats. The technique used by Dr. Jeffreys to examine the VNTRs was called restriction fragment length polymorphism (RFLP) because it involved the use of a restriction enzyme to cut the regions of DNA surrounding the VNTRs. This RFLP method was first used to help in an English immigration case and shortly thereafter to solve a double homicide case[45].

Since that time, human identity testing using DNA typing methods has been widespread. The past 20 years have seen tremendous growth in the use of DNA evidence in crime scene investigations as well as paternity testing. In addition, most countries in Europe and Asia have forensic DNA programs. The number of

[45] Yashpal Singh and Mohammad Zaidi ,"*DNA Test in Criminal Investigation, Trial and Paternity Disputes*" , Alia Law Agency, Allahabad, 2006, p. 101

laboratories around the world conducting DNA testing will continue to grow as the technique gains in popularity within the law enforcement community. In India there are 24 central laboratories working to preserve, protect and maintain the record of DNA evidence.

Historical perspective of discovery of individual's identifying techniques:

1.2 Identification of Individuals

i. Identification of Individuals through Fingerprints-

Fingerprints were considered as one of the most reliable physical evidence used in the determination of the identification of the person. In 17th century English Botanist Dr. Nehemiah Grew, fellow of the college of Physicians and of the Royal Society was the first person to documents his findings about the ridges on the hands in his paper published in 1684.[46]

In 1880, Scotish physician Dr.Henry Faulds and British administrator sir William Herschel described that every individual has a different fingerprinting. Scientist Sir Fransis Galton approved there research and conclusion. In 1973 Sir Edward Henry, A British Indian Civil servant in India had described about fingerprinting classification system in his book "Classification and uses of fingerprints" based on Francis Galton's book "Fingerprint" and subsequently it was adopted in British India. The exhaustive comprehensive study and research work on fingerprinting was carried out by Galton in 1892 for the purpose of criminal investigation. In 1896, Henry fingerprint classification system was first used by the police of Argentina to solve a murder mystery of a child by comparing the fingerprints of suspect and fingerprints found on crime scene[47].

In 1860, it was first time introduced in India and was used for identification of an illiterate British soldier for the payment of military pension. In India, science of finger printing is widely used, whereas in western countries it is rarely used as there is almost no use of thumb impression due to high percentage of literacy.

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[46]See, Article on "History of the Metropolitan Police Fingerprint Bureau ,Available at http://www.met.police.uk/history/fingerprints.htm (Last accessed on 24th Jan., 2007)
[47] Ibid

Limitations:

This for 150 years was the primary source for identification of individuals. But later it was found that even fingerprints can be altered by surgery. Also the problem with the fingerprints is that the two individuals can have the same fingerprints although the chances are very-very low. There are conflicting opinions of various experts in case if the fingerprints are blurred.

ii. Through Blood Grouping test:

Karl Land Steiner[48], who was given a noble prize in 1930 for dividing blood into four distinct groups, and this also, formed the basis for identification of an individual.

1901- Karl Landsteiner discovered the methods by which blood could be grouped into different categories.

1915-Italian scientist Dr. Leone Latters developed procedure for determining blood groups of blood stains.

1940 –Rhesus (IRh) system was discovered for solving paternity disputes by Landsteiner and wiener.

1947- 5 groups were discovered.

The human blood can be genetically transmitted as it holds certain characteristics. The blood groups which were earlier used for paternity testing were 'ABO', 'MNS' and Rh.

Limitations of blood group system:

They may exclude a certain individual as the possible father of the child but cannot possibly establish paternity. Blood test can't be used positively to establish paternity, but they can increase the denial of possibility of the paternity. i.e a person can or cannot be the father of a child. Even in case of the conflict between two persons with

[48] See, Article on DNA Technology, Available on notable twentieth-century scientists. gale research, 1995.reprinted by permission of The Gale Group.Link: http://www.galegroup.com http://www.pbs.org. /wnet/redgold/innovators/bio_landsteiner.html (Last accessed on 6th February, 2007)

whom the mother of the child had the intercourse, if they undergo a blood test that there is 80% chance the test will show that one of them is or both of theme are not the father/fathers of that child.

Today more than 100 different factors in human blood are known which may vary in different individuals. Thus there had been clearly a need of another marker, which is conclusive in exclusion so as to minimize the high increase in the error rate in wrongful convictions and acquittals

This need was fulfilled by Alec Jeffrey's method by which individual specific polymorphism can be detected. DNA fingerprinting/profiling was developed in 1985 by Alec Jeffrey and his colleagues at Leicester University (England) who named the process for isolating and reading DNA markets as "DNA Fingerprinting".

Forensic use of DNA technology in criminal cases began in 1986 when police asked Dr. Alec J. Jeffrey to verify a suspect's confession that he was responsible for two rape-murders in the English Midlands[49]. Tests proved that the suspect had not committed the crimes. Police then began obtaining blood samples from several thousand male inhabitants in the area to identify a new suspect.[50]

In a 1987 case in England Robert Melias became the first person convicted of a crime (rape) on the basis of DNA evidence.[51] In one of the first uses of DNA in a criminal case in the United States, in November 1987, the Circuit Court in Orange Country, Florida, convicted Tommy Lee Andrews of rape after DNA tests matched his DNA from a blood sample with that of semen traces found in a rape victim[52].

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[49]The first reported use of DNA identification was in a no criminal setting to provem a familiar relationship. A Canadian boy was refused entry in U.K. for the lack of the proof that he was son of women who had the right to settlement in U.K. immigration authorities contained that the boy could be the nephew of the women, not her son. The DNA testing showed the mother-son relatioship. The U.K. Government accepted the test findings and admitted the boy See "Methods and application of DNA fingerprinting; A guide for the non-scientists' Criminal Law Review 1987 p.105.

[50]See, Article written by Gill Peter Alec Jeffery and David J. Werret "Forensic application of DN fingerprinting" Available at http:/www.pbs.org./wgbh/pages/frontlineshows/case/revolution /wars.html. (Last accessed on: 9th February,2007)

[51] See, Article , Available at http://web.utk.edu/ (Last accessed on: 12th February, 2007)

[52]Admissibility of DNA evidence was upheld by the intermediate appeals court, which cited the uncontroverted testimony of the state's expert witness. Ibid 51.

Two other important early cases involving DNA testing are State v. Woodall[53] and Spencer v. Commonwealth. In Woodall, the West Virginia Supreme Court was the first State High court to rule on the admissibility of DNA evidence. The court accepted DNA testing by the defendant, but inconclusive results failed to exculpate Woodall. The court upheld the defendant's conviction for rape, kidnapping, and robbery of two women. Subsequent DNA testing determined that Woodal was innocent, and he was released from prison.

The multiple murder trials in Virginia of Timothy Wilson Spencer were the first cases in the United States where the admission of DNA evidence led to guilty verdicts resulting in a death penalty. The Virginia Supreme Court upheld the murder and rape convictions of Spencer, who had been convicted on the basis of DNA testing that, matched his DNA with what of semen fond in several victims.[54]

The first paternity dispute in India[55] which was solved by DNA fingerprinting test was the case no. M.C. 17 of 1988 in the court of Chief Judicial Magistrate of Telicherry .The Chief Judicial MAGISTRATE held that "The evidence of expert is held admissible under sec 45 of the Indian evidence Act. And it is also relevant under sec-51 of The Indian Evidence Act." Dr. Lalji Singh is known as the founder of the DNA technology used in Indian Legal system.

iii. Through DNA fingerprinting:

Following is the chronological development in DNA fingerprinting[56]:

1. DNA Fingerprinting by doctor Alec Jaffrey (U.K.) -1985
2. DNA profiling –by FBI (RFLP) -1988
3. PCR DQalpha and Polymarker tm-1990
4. PCR STRs-1993
5. Mitochondrial DNA -1996

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[53] See, Missisippi Court Opinion, Fifth Circuit, Available at http://www.mslawyer.com. (Last accessed on: 12th February, 2007)

[54] See,Case Discussion,http:pbs.org/wgbh/pages /frontline/shows/cases/revolution/wars.html.(Last accessed on: 13th February, 2007)

[55] M. W. Pandit and Dr. Lalji Singh 'DNA testing, Evidence Act and Witness testing' *The Indian Police Journal*, Dec. 2000 p.100 (Cr.L.J. 2004)

[56] Yashpal Singh and Mohammad Zaidi "*DNA Tests in Criminal Investigation, Trial and Paternity Disputes*", Alia Law Agency, Alahabad, 2006 p. 95

6. Multi-Plex STRs-1997
7. Y-CHROMOSOMS Analysis-
8. SNPs
9. CHIPS

1.3 First time uses of DNA Evidence

Following is the chronology of the use of DNA for the purpose of Legal proceedings or investigation[57]:

- 1986- Prof. Alec Jeffreys innovated and applied first DNA test of two teenaged girls rape and murder case in U.K.
- 1986-First exoneration through post –conviction test in U.K.
- 1987- Robert melias was the first person got conviction on the basis of DNA evidence in U.K.
- 1987- DNA evidence produced first time in U.S.A.
- 1987- DNA test first used in Tommy Lee Andrew of U.S.A. in a rape case.
- 1989- DNA evidence got legal validity in India.[58]
- 1989- DNA evidence was first time produced in court in India.[59]
- 1994- Crime of century case of O. J. Simpson produced in the court.
- 1996, Mitochondrial DNA analysis was first used in the case of Tennessee in U.S.A.
- 1998Canada has passed "DNA Identification Act, 1998"and was assented in 2000
- 2003, U.S.A. passed 'Advancing Justice through DNA Technology Act, 2003"
- 2003, U.S.A has passed "Justice for all Act, 2004.'
- 2005, provisions for DNA profiling are included in the Code of Criminal Procedure by passing The Code of Criminal Procedure (Amendment) Act 2005 in India.

[57]Yashpal Singh and Mohammad Zaidi *"DNA Tests in Criminal Investigation, Trial and Paternity Disputes"*, Alia Law Agency, Alahabad, 2006 p.97
[58] Kunhiraman v. Manoj, (1991) 3 Crimes 860 (Ker.)

Social, Ethical, Economic and Religious perspective of DNA Technology:[60]

The introduction of any new technology is likely to raise concerns about its impact on society. Financial costs, potential harm to the interests of individuals, and threats to liberty or privacy are only a few of the worries typically voiced when a new technology is on the horizon.

2.1 Ethical Aspects:

Ethical considerations regarding the use of DNA technology in forensic science overlap with various issues addressed in social and legal analyses including substantive and procedural rights of people and overall no monetary costs and benefits likely to result from establishing the use of the new technology in courtroom proceedings.

A threshold question for any ethical inquiry is whether the action or practice under discussion is intrinsically wrong. An action or practice is intrinsically wrong if it violates fundamental ethical principles. These have traditionally been held to include prohibitions against enslavement, torture, gratuitous infliction of harm on human beings, and modes of exploitation that use humans as merely a means (usually without their knowledge or consent) to serve the ends of others. To hold that such actions or practices are intrinsically wrong is not to claim that they can never be justified. For example, if torturing a terrorist who knows the location of a bomb planted to kill a million people is the only way to avert the tragedy, then torture might be justified. That would not yield the conclusion that torture is ethically right, but rather would show that evil acts can sometimes—albeit rarely—be justified as a means of preventing much greater harm.

DNA technology in forensic science is unlikely to violate any fundamental ethical principle of the type described above. Although DNA technology involves new scientific techniques for identifying or excluding people, the techniques are

[60] See, 22 1977 Cr.L.J 1797 (AP)
And 1985 Cr.L.J 974 (Guj)
And Sec 4 of Indian Evidence Act, 1872.
Sec 112 read with Sec4 of Indian Evidence Act, 1872.
Also see AIR 1993 SC 2295

extensions and analogues of techniques long used in forensic science, such as serological and fingerprint examinations, handwriting analyses, photography, and examination of teeth. Ethical questions can be raised about other aspects of this new technology, but it cannot be seen as violating a fundamental ethical principle.

A new practice or technology can be subjected to further ethical analysis by using two leading ethical perspectives. The first examines the action or practice in terms of the rights of people who are affected; the second explores the potential positive and negative consequences (nonmonetary costs and benefits) of the action or practice, in an attempt to determine whether the potential good consequences outweigh the bad.

2.2 Bioethics:

Summa Ratio Est Equae Pro Religion Facit-The Best Reason Is That Which Is In Favour Of Religion.

Science, Law, and Religion have been continuously remaining in conflict with each other. The questions of the social use of genetic information gained through DNA testing also arise and must be debated at an ethical level also.

- Is it now open to parents to choose the kind of children they will have and if so, what are the consequences of such choices?

- Stem cells research also raises serious ethical issues. Nobody wants to know how he will die and when and would rather live without that knowledge. Such a dilemma might only be expected to face characters in a science fiction novel or film until now. Genetic test, which promises to foretell our medical future, are being sold in growing numbers, thus causing ethical problems.

By far the biggest public concern recently has come with new developments in the life sciences, - Some of the ethical issues relating to cloning and genetically modified organism have been exaggerated, some of which are as under[61]:

[61]See, Article on Bioethics, *The National Academic Press*, Available at http://www.nap.edu/openbook.php (Last accessed on: 27th February, 2007)

- The potential to misuse genetic information about individuals
- The question of who owns genes and genetic code
- The implications of patenting knowledge that traditionally has been shared
- The acceptability of cloning human beings for reproductive or other purposes
- The acceptability of transferring genes from one animal species to another
- The safety of genetically-modified organisms, both in terms of the environment and the consumer, including reduced biodiversity.

2.3 Non monetary Costs and Benefits:

The ethical perspective by which actions or practices are evaluated in terms of their good and bad consequences is fundamentally sound. Nevertheless, it suffers from both theoretical and practical difficulties. Not only is it difficult to predict good and bad results in advance of gathering sufficient evidence about projected consequences, but it is also sometimes hard to weigh consequences, even if they have already come about. For example, how is it possible to weigh the good consequences of enabling positive identifications to be made with greater certainty by using DNA technology against the bad consequences of drawing mistaken conclusions in particular cases where laboratory techniques or personnel are substandard? Even well-done tests can yield false positives. In approximately 35% of cases performed by the FBI to date, the primary suspect was excluded by DNA (tests on persons who had been prescreened). However, that observation does not resolve the problem of weighing good consequences against bad ones, although it does provide some information that could be used in such weighing.

Another factor to be weighed in a consequential and ethical analysis is whose interests are to count and whether some people's interests should be given greater weight than others'. For example, there are the interests of the Accused, the interests of victims of crime or their families in apprehending and convicting perpetrators, and the interests of society. Whether the interests of society in seeing that justice is done should count as much as the interest of the accused or the victim is open to question?

Here there is an obvious overlap with an ethical analysis from the perspective of rights, and assessment of the consequences of instituting a new practice should include the effects of the new practice on the rights of the people involved.

Especially when a practice is new and information on projected consequences is scanty, there are problems with relying on balancing the good and bad consequences as a mode of ethical analysis. People who favor one policy or practice predict a balance of good consequences over bad ones, and detractors do the opposite.

One important factor contributing to uncertainty about the use of DNA typing technology is the existence of disagreement among scientific experts. When experts disagree about the use of techniques or statistical methods (such as extrapolations based on population genetics) or about the interpretation of data, the uncertainty is of a different sort from uncertainty that stems simply from scanty evidence drawn from actual consequences. The latter uncertainty can be remedied by gathering more data before a technology is introduced as an accepted standard. If controversy among experts persists, disagreements can erupt whenever empirical evidence is analyzed and specific conclusions and questions are to be addressed or answered, which can be as follows:

- DNA typing technology has the potential for uncovering and revealing a great deal of information that most people consider to be intensely private.
- 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?
- Parameters of privacy and confidentiality of the genetic information along with its controls have to be suitably defined.
- Psychological impact/ trauma 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?
- It needs to be seen that how does personal genetic information affect an individual and society's perceptions of that individuals.
- Issues related to the use of genetic information in reproductive decision making and reproductive right;

2.4 Questions raised because of the Genetic testing:

The genetic testing may arise following ethical, legal and social questions:

What if it causes unnecessary stress and unwelcome changes in personal relationships?

Should genetic testing be carried out where there is no treatment available as in albinism and dwarfism?

How to address the following cases in the light of genetic testing?

- Genetic testing for insurance

- Genetic testing for new employees

- Genetic databanks for forensic use

- Genetic databanks for institutionalized children

Would it cause social biasness? What if people with 'aggression genes', 'cancer genes' or 'mood-swing genes'?

Matters concerning commercialization of products including property rights and accessibility of data and materials. Like who owns genes and other pieces of DNA? The mindset of all concerned in this regard has to be suitably made clear.

a) Ethical, Legal, and Social Concerns about DNA Data banking:

Questions regarding Genes and Privacy:

What if your blood sample for medical check-up is used for research or other purposes without being informed?

The federally established human genome program will yield an unprecedented amount of genetic information and generate new databanks even apart from the human genome program, DNA technology is moving forward; but this large-scale program, projected to take 10-15 years, is bound to accelerate the acquisition of genetic information. At the same time, it contains a mandate for examining the ethical, social, and legal implications of mapping the human genome, with specific allocation of funds for examining these aspects. A central concern raised by these developments is the safeguarding of the confidentiality of personal genetic information. With greater understanding of the human genome, the potential of misuse of DNA samples collected or preserved for purposes of criminal justice will increase. The more databanks are established, the greater the risk of breaches of confidentiality and misuse of the information.

3. Universal declaration on the Human Genome and Human Rights and Ethics

Science has raised ethical questions before. The most obvious case is the applications of atomic energy. But whereas atomic energy was shrouded by military secrecy, the recent developments in the life and health sciences are very much in the public arena. The fact that there is a public outcry is as important as whether or not it is justified. It proves that scientists cannot do whatever they want, and are accountable at least in a society based on democratic principles. "The behavior of the scientific community in general is positive", says UNESCO Director-General, Federico Mayor, "and I think they deserve trust". But, he says, it is the task of ethics to draw the line between what is possible and what is acceptable. This can be done neither by science nor by technology. To draw this line, he set up a 55-member International Bioethics Committee (IBC) in 1993, which, after four years of meetings and public debates, drafted a Universal declaration on the Human Genome and Human Rights, the first in

the field of genetics within the United Nations System. Although the Declaration is not binding, it represents a moral commitment of all Member States to adhere to a coherent set of principles in the field of genetics[62].

Articles 5 to 9 of the Declaration make provision to protect the rights of the individual regarding research or treatment that may affect his or her genome, as well as the confidentiality of genetic information, in the conditions set by law.

Article 17 encourages the practice of solidarity towards individuals, families and population groups who are particularly vulnerable to or affected by disease or disability of a genetic character. These articles are intended to protect against eugenic practices.[63]

Research on embryonic stem cells is one of the most controversial issues today. Such research should in the future make it possible to create organs and tissue, of which there is currently a severe shortage, for transplantation purposes. Spectacular progress is expected in the dealing with diseases, which are currently either difficult or impossible to treat (such as Parkinson, Alzheimer, and Multiple Sclerosis etc.). But the fact that these stem cells mainly come from human embryos raises the question of whether we should create embryos for the sole purpose of facilitating research. Opinions on the subject of embryonic stem cells differ widely. As the Report of UNESCO's International Bioethics Committee (IBC), The Use of Embryonic Stem Cells in Therapeutic Research makes clear: "The ethical legitimacy of performing human embryonic stem cell research depends, in large measure, on the status which is attributed to embryo.

The prospect of human cloning is sparking intense debate. Some still warn that cloning for reproductive purposes will be conducted, despite the fact that it has been banned both by UNESCO's Universal Declaration on the Human Genome and Human Rights (1997), which describes cloning as contrary to human dignity (Art.11), and by legislation in many countries. Although the international community has already rejected human cloning for reproductive purposes as an unacceptable

[62] See,Article Science for the 21st century : A New Commitment "The possible and the acceptable ethics in science", *UNESCO's Office of Public Information,* 2002 p. 124 ,Available at www.unesco.org/bpi/science/content/press/anglo/3.htm (Last Accessed on 4th March 2007)
[63] Ibid 62

instrumentalisation of the human being, questions remain regarding therapeutic cloning. With the progress of genetics, a new type of diagnosis, which also presents a threat, has come to light, which is pre-implantation genetic diagnosis. Such diagnosis is currently restricted for the detection of serious diseases may yet be used for eugenics, in other words, for the selection of individuals. It may become very tempting to use this diagnosis technique for enhancement purposes or to select certain physical characteristics.

The collection, treatment, storage and use of genetic data raise a host of ethical questions. UNESCO is considering an international instrument on genetic data and the IBC, which has published a report on genetic data, has examined several of its aspects:

The aim of the genetic data collection;

- informing sample donors;
- free and informed consent on the part of donors;
- regard for the particular sensitivities of particular social,
- religious and ethnic groups regarding human tissue;
- precautions which must be taken when conducting genetic tests, such as parentage testing, considering their implications for the people tested and others;
- The confidentiality; and fate of the samples.
- Some of the problems concerning genetic data, such as confidentiality and consent, can already be found – sometimes under different names – in conventional medical practice.
- As far as human organ and tissue donations are concerned, the field of bioethics is expanding. This field has been facing major questions for some time. Notably:
- How to avoid the emergence of trafficking in human organs – such as kidneys, liver and pancreas – or of human tissue – cornea or bone marrow etc. – for which there is a strong demand.
- Genetics now raise new questions, about, notably, the use of xenotransplantation (the transplantation of genetically engineered animal

organs into a human body) and genetic engineering in stockbreeding as a potential source of organs which are compatible with the human body. The life sciences are constantly adding to these already numerous and often intertwined ethical quandaries and this is why UNESCO has chosen the Ethics of Science and Technology as one of its five major priorities in its Medium – Term Strategy for 2002 to 2007[64].

4. Moral Rights

Two main questions may arise about the moral rights because of the DNA Technology:

1. Does the use of DNA technology give rise to any new rights not already recognized?
2. Does the use of DNA technology enhance, endanger, or diminish the rights of anyone who becomes involved in legal proceedings?

In answer to the first question, it is hard to think of any new moral rights not already recognized that come into play with the introduction of DNA technology into forensic science. The answer to the second question requires a specification of the classes of people whose rights might be affected and what those rights might be.

The people whose rights might be endangered or diminished seem to be chiefly those who are suspected or accused of or indicted for a crime or involved in other legal proceedings, such as paternity suits, denaturalization, or immigration matters. Does use of DNA technology interferes with or diminish their rights in any way? Might it enhance their rights? Which rights might be endangered?

The current use of DNA technology appears to pose no greater threat to the right to privacy than does normal fingerprinting, placement of photographs in evidence, collection of blood or saliva samples, or other established forensic techniques. DNA technology is not different in principle from those other techniques, although it holds the promise of providing a more definitive identification than most others. The fingerprinting is likely to remain the best for a while. If the use of DNA information

[64] See, Article "Challenges of Bioethics" as appeared in , From *UNESCO Press Release* ,Available at http://www.nap.edu/openbook.php (Last accessed on: 28th February, 2007)

can be strictly limited to defendant identification, it involves no greater intrusion into the privacy of an accused person than do traditional methods in forensic science, whose aim is to make as definitive an identification as possible. Without strict limits, however, DNA information can be more intrusive into privacy, in that it provides more information about a person.

In some ways, the use of DNA information about suspects can be less intrusive than traditional methods. "Rounding up the usual suspects" by checking a DNA sample against a computerized databank is both much easier and less intrusive than rounding up the suspects themselves. But people who are rounded up are made aware that they are under suspicion and can take protective steps. Where databanks already exist, a fresh blood sample would have to be taken from suspects for confirmation. Thus, it is a complex matter to determine whether the rights of suspects are enhanced or endangered by the use of DNA evidence in the forensic setting, which requires empirical evidence to be subjected to careful analysis.

Concerns about intrusions into privacy and breaches of confidentiality regarding the use of DNA technology in such enterprises as gene mapping are frequently voiced, and they are legitimate ethical worries. The concerns are pertinent to the role of DNA technology in forensic science, as well as to its widespread use for other purposes and in other social contexts. A potential problem related to the confidentiality of any information obtained is the safeguarding of the information and the prevention of its unauthorized release or dissemination; that can also be classified under the heading of abuse and misuse (discussed below), as well as seen as a violation of individual rights in the forensic context.

People have a right not to be wrongly convicted of a crime. To protect that right, a high standard of proof is imposed before a person may be found guilty. In addition, techniques used in gathering and analyzing evidence must have proven reliability (comprising accuracy, precision, specificity, and sensitivity) and should be accepted by a consensus of the scientific community. If DNA technology is as good as or better than other methods used to identify criminals and if; the implications and limitations of DNA evidence are recognized by judges and jurors, its use should pose no greater danger to the rights of accused people than the use of currently approved techniques of forensic identification. Moreover, the reliability of DNA evidence will permit it to

exonerate some people who would have been wrongfully accused or convicted without it. Therefore, DNA identification is not only a way of securing convictions; it is also a way of excluding suspects who might otherwise be falsely charged with and convicted of serious crimes.

5. Religious issue:

In an interesting article of Sophie Boukhari, UNESCO Courier journalist, an array of responses to the bioethical questions posed by genetic technologies, by Catholics, Protestants, Buddhists, Muslims and Jews are referred. "Although religious practice may be declining", says French geneticist and Member of Parliament Jean Francois Mattei, "the metaphysical issue is still at the core of the questions raised about genetic engineering, either by tradition, culture or duty." Should a person have recourse to prenatal screening and consider having an abortion if a serious genetic defect is discovered? Should research on embryos, gene therapy and cloning be allowed? All the "religions of the Book" (Christianity, Judaism and Islam) believe that the answers to these questions largely depend on the status of the embryo. The frontier between "good" and "bad" genetic engineering depends on whether or not the embryo is considered to be "animate". "If the embryo has soul, then it is endowed with a human as well as a biological life and any attack on its integrity is seen as a crime", says French Geneticist Rene Freedman. Following are the most commonly known views of the specific religions in relation DNA Technology[65]:

i. Jews allow experiments with embryos, especially if they have no chance of surviving. Judaism also does not rule out cloning, says French Theologian and Jurist Raphael Brai; "If cloning is done for the therapeutic reasons, the matter has to be discussed with other people. Several religious notions clash at this point, for example, the oneness of the human person and the duty to heal oneself." But cloning for reproductive reasons is not allowed, with few exceptions.

ii. Protestant Christians are generally more open to advances in genetics. They stress free will and regard each case on its merits, leaving the decision to the couple involved.

[65]See, Sophie Boukhari, "Religion, genetics and the embryo", *UNESCO Courier* (Sept, 1999) Available at http://www.nap.edu/openbook.php (Last accessed on: 28th February, 2007)

iii. Buddhists are even less dogmatic because they believe all truth is relative. A French expert in Buddhism, Raphael Liogier, notes, "the only ethical limit is suffering, for Buddha is primarily a healer". The Dalai Lama, leader of Tibet's Buddhists, says what mainly has to be taken into account are "the good effects and bad effects of genetic engineering". He agrees that it can be used to "improve the human body – the brain, for example." "The body is only a vehicle for karma [the ethical consequences of a person's actions that determine their destiny in their next incarnation]", says Liogier.

iv. Most important of all, while all the major religions generally believe human life and dignity should be respected, the Church of Rome is the only religion that considers the embryo "as a human being from the moment of conception", and it sticks firmly to this doctrine. The Vatican is against both the reproductive and therapeutic cloning on the grounds that it violates the "unified totality" of the human person and the sacred link between sexuality and procreation.

v. As per Islam philosophy - H'mida Ennaifer, of the Higher Institute of Theology in Tunis, says "Islamic jurists all condemn abortion after the fetus has received the breath of life. Some Malekites condemn it even when the child is less than 40 days old while other schools of thought allow it during the first four months of pregnancy." Islam also allows gene therapy on the human body, but in general it proscribes the modification of germ cells and bans anything which denies the notion of divine creation, starting with cloning. However, a minority of jurists regards cloning as sometimes preferable to "genetic adultery" because it respects the line of descent by avoiding a situation where a sterile couple uses sperm or eggs from a donor in artificial insemination.

As noted above, the provisions of the Universal Declaration on the Human Genome and Human Rights explicitly outlaw human cloning for reproductive purposes, as contrary to human dignity. Human dignity, inherent to each individual, excludes all practices, which tend towards the 'reification' of an individual or his or her 'instrumentalisation'. In other words, a human being is a subject, not an object, for science. Several countries, including United Kingdom, United States of America, Canada, Germany, have laws or are drafting laws banning human reproductive cloning.

It is now technically feasible to take a gene from one species and make it part of the genome (genetic 'blueprint') of another species. A toxin-producing gene from a bacterium can be added to corn to make it pest-resistant. The gene that makes a firefly glow at night can be added to a plant's DNA to make the leaves light up when the crop is ripe. A cow can be 'engineered' to produce a drug in its milk. Human genes can be added to a pig's genome so that it grows organs for transplantation to man without being rejected by the patient. In general, the creation and release of genetically modified organisms (GMOs) raises a different type of issue – bio-safety. There is a risk that a transgenic plant will cross-pollinate a natural variety and produce mutations with unknown results. Large scale planting of pest-resistant biotechnological plants exposes the pest to the toxin on a scale unknown before. This can give insects and viruses a much greater imperative to become resistant – otherwise the species might die out. Organic farmers are afraid that a new strain of toxin-resistant insect would wipe out their crops. "On the other hand, an insect-free environment is also likely to be a bird-free environment."[66]

vi. Hindu Vedanta philosophy:

The Hindu religious history Mahabharata and other *Puranas* discusses about the use of modern genetics and related technologies, of which few examples are as under,

- Birth story of Kauravas
- Birth of Krishna, Balram and jog maya
- Birth story of karn.. The Technology has its roots in the past. The Vedanta Philosophy says that on one side the DNA technology has facilities the human activities but on the other hand, as every coin has two sides, it has created the danger for the very existence ofhumanbeings. We need the healthy combination of science, technology, modernization, religion and spirituality[67].

[66]See: Honourable Mr.Justice R.K.Abichandani, "Science for the 21st Century: A New Commitment "The possible and acceptable ethics in science"paper presented in a conferednce on "Gene Age" (October,2003), Available at gujarathighcourt.nic.in/Articles/legalpers.htm (Last Accessed on 15th March 2007)

[67] See, Article published in *Prabudha Bharata /Awakened India* monthly Magazine established and started by Swamin Vivekanand-The disciple of Ramkrishna Param Hansa of Ram Krishna Mission,(2007)

vii. Greek philosopher Plato said, "positively gathered society of morally just individuals is a just society."[68] The law and society both reflect and shape each other .Nor is law abstract and remote from every day life, law effects you personally in ways which might not seem immediate obvious. Aristotle describes justice as a practice of perfect virtue is a question of abstract principle. Information vacuum among minorities may lead to Ethical, Social, and Political Dilemmas.

6. Economic Aspects:

The following points have to be considered for understanding the economic perspective for the DNA Technology:

- The forensic use of DNA technology will have various economic impacts.
- The proliferation of DNA evidence in investigations and trials requires a fairly rapid expansion in the number of reliable experts and laboratories.
- The cost of the equipment, training and proficiency programs, supplies, and personnel will be very large.[69]
- Material will have to be stored for databanks and for checking suspects. Costs will be associated with the upgrading and changing of databanks when new procedures are adopted.
- Those costs will affect budgets for police, prosecutors, and courts. Indigent criminal defendants might have a constitutional due-process right to have an expert witness paid for by the government.
- The courts themselves must be supplied with reliable assistance in evaluating DNA material[70]. The government will generally have to bear this cost. However, if a defendant can afford the cost and asks for expert assistance, the court can assess some costs against the defendant and some against the state.
- New costs will also be related to training and certification. The implementation of any new technology requires training and certifying of

[68] V.D. Mahajan, *"Jurisprudence and Legal Theory"* , 5th Edition,2011

[69] For example, the three proposed regional laboratories in New York State are estimated to cost $1.4 million per year. The Commonwealth of Virginia has committed several million dollars over the last 3 years to its forensic DNA activities (Paul Ferrara, personal communication, 1990).

[70] In the federal system, the court can request an expert or panel of experts to assist it, pursuant to Rule 706 of the Federal Rules of Evidence. A special register of scientific experts can be maintained for ready access.

personnel. Additional costs will be incurred to develop mechanisms to ensure quality control of laboratories that conduct forensic DNA testing.

- New technology can grow and make ever larger fiscal demands on society. It is difficult to predict the total cost of DNA testing when it becomes generally available nationwide, but it is reasonable to expect it to amount to tens of millions of dollars a year. That cost is unavoidable, but, given the present fiscal problems at all levels of government cannot be ignored.
- Setting up regional and cooperative services is one way of controlling costs. It might not be feasible or appropriate for some small forensic science laboratories to create their own DNA testing capabilities.
- In U.S.A., a major DNA testing center run by the FBI might reduce costs to smaller localities. That potential reduction in monetary cost needs to be balanced against the risks to privacy and confidentiality of having a powerful federal law-enforcement agency in charge of DNA testing and storage of DNA information.
- If laboratories come to share information, everything could eventually become linked. At the same time, the risks that privacy and confidentiality will be breached might be as great or greater with local control, in that state laws governing the use of criminal records vary widely.
- It is likely that the cost of criminal justice will be increased. In some cases, however, early exclusion of suspects who have been cleared by forensic DNA evidence will reduce cost in the judicial system. On balance, the increased costs are small relative to the cost of operating the entire system. The committee believes that the expenditures are warranted by the advantages to be expected.
- In India, if we think of establishing such Laboratories, it will cost a very high amount of currency investment in the gigantic project of DNA Labs all over the India.
- Huge amount of money is required to spend on establishment of DNA Data Bank, maintenance cost, service charges, investment on instruments, storage, transportation charges, expert person's fees etc.