Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
NEW LAW COLLEGE
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LL.M II Semester III[2014 Pattern]

Paper 10

LAW, SCIENCE AND TECHNOLOGY

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B.A.,LL. M.(SET)

(Paper -10)

Compulsory Paper **Credits: 4**

LAW, SCIENCE AND TECHNOLOGY

Objectives: The aim of the course is to introduce in brief to the student about the developments in the field of Science and Technology and the relationship between Law and Science and Technology. The paper further seeks to explore some specific aspects to test the possible interactions, controversies and their interrelationships between both the aspects. Further, it focuses on the relationship between Human Rights and Science and Technology and the need to regulate science and technology in order to preserve the basic concept of sustainable development.

I) Introduction:

a) Developments in Science and Technology

b) Science & Technology Vis a Vis Sustainable and equitable develop .

c) Impact of Human Rights on Science & Technology

d) Human Rights and preservation of human health

II Science - Technology and Relationship with Law

a) Nexus between science technology and law

b) Problems and Perspectives between Law and Science

d) The need for legal control of Science and Technology.

e) Clinical Trials and the Need Professional responsibilities and ethical principles.

III) Privacy, Law and technology:

a) Origin and Development of Law of Privacy

b) Concept and Nature and Law of Privacy

c) Law of Privacy Vis-a Vis Science and Technology

V) Use of Science and Technology in Judicial Investigations:

(a) The Significance of Science and Technology in the Lega Proceedings.

(b) The Significance of Forensic science in the Criminal Matters

(c) The Indian Judiciary on the Use of Science and Technology

VI) Biotechnology & Law:

a) Origin and Development of Bio Technology

b) Debatable issues in biotechnological innovations

c) Ethical and Moral implications on the use of Genetic Engineering

VII) Nuclear Technology and La w:

a) Uses & misuses.

b) Legal control- national and international scenario .

c) Human Rights Vis-avis Nuclear Technology

Suggested bibliogr aphy

The material for the course shall be traces on relevant websites of the universities and research institutes at the national and international levels.

Suggested Readings:

1) Markandey Katju, Law in scientific Era (2000) Universal, New Delhi

2) Cees J.Hamelink, the ethics of cyber space(2001)sage.

3) Jonh Zinian et.al(ed) World of Science and Rule of Law (1986) Oxford

4) U.Baxi,Biotechnology and Legal Order: Dilemmas of the future of Law and Human nature.(1993)

Journal of national and international repute on the subject. (Print and electronic)

Paper No. 10

LAW, SCIENCE AND TECHNOLOGY

Index

Topic No. 1

Introduction:

- INTRODUCTION

'Technology transfer' means the use of knowledge and when we talk about transfer of the technology, we really mean the transfer of knowledge by way of an agreement between the states or companies. 'Transfer' does not mean the movement or delivery; transfer can only happen if technology is used. So, it is application of technology and considered as process by which technology developed for one purpose is used either in different applications or by a new user.

A. Elements of Technology

Technology generally would comprise the following elements:

Process Know how

Design Know how

Engineering know how

Manufacturing know how

Application Know how

Management know how

The technology what we have utilizing today supports the necessity for human comfortable life zone. The field in improvements is basically takes place on Medicine, Energy, Agriculture and Resource Management which makes greater impact on the society. Sound decision making and economic planning are necessary for nation's sustainable development. The global look must address the scientists and entrepreneurs from all over the nations for towards the improvement of sustainability. The report framed by Brundtland commission defines the sustainable development as "the development that meets the needs of the present, without compromising the ability for the future generation to meet their own needs".

- NUCLEAR TECHNOLOGY

Technology can either be developed through own research and development or it can be purchased through indigenous or imported sources. Radiation techniques are used in agriculture for producing high yields with better crops. The technique called Nuclear Sterilization (NS) is used to eradicate the tests flies and have also been used to control the harmful effects of pesticides for human being. Radiation techniques are also has an application to preserve food by eliminating bacteria and pathogens that can cause disease.

It also prevents the harmful effects of chemicals that are presently being used in fumigation of food. For effective sustainable agriculture and to get maximum benefits such as water and fertilizer the nuclear techniques are used to optimize the intake of water and fertilizer-uptake. This technique is also used for mapping of micronutrients. Nuclear techniques are used in mutation-breeding have resulted in producing improved varieties of cotton, wheat, chickpeas, mungbeans and rice. Fig. 1 shows the Nuclear power production in India.

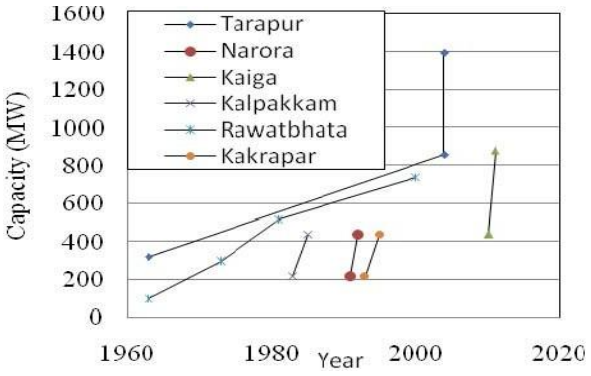

Fig. 1. The Nuclear power production in India.

- HUMAN HEALTH AND MEDICINE

Human health is one of the key factor that must be addressed today's sustainable development. Nuclear techniques are used to diagnose and treatment of diseases. Nowadays it is one of the powerful diagnostic techniques. Radioscopic techniques are used in the area of health science in treatment of cancer as the cases of cancer are increasing rapidly all over the world. Gamma irradiation facility is used for sterilizing the medical equipment.

- WATER RESOURCES

Clean water is the need of the hour all over the world and an increasing awareness in the world that fresh water is a precious and limited resource. Ground water is shrinking due to over-exploitation and being lost due to degradation of water –quality from pollution cause by humans. The standard of living and over population are the main demand for produce clean water. Global warming is also one of the additional inputs for demand for water. Sustainable improvement in freshwater resources requires appropriate technologies like radioactive isotopes and radioactive tracers.

- INDUSTRY

Non-destructive Testing (NDT) is a quality control technique and quality assurance is the key requirement in modern industry. Services using nuclear control techniques are being used in a number of industries, including oil sectors, fertilizers and chemical plants. The services are also extendable to hydroelectric and thermal power plants. The quality assurance laboratories using nuclear analytical techniques are essential requirements in industries.

- INFORMATION TECHNOLOGY

Information technology plays a vital role in today's societal importance, knowledge and intelligence empowers both people and machines with information. The utilization of machines, men, method and money contributes effective sustainable development. Empowered people are playing the role as citizens to support environmentally sustainable society similarly empowered machines have the knowledge to minimize energy and material use, wastes and pollutants. Information technology improves the facilities faster, cheaper and equitable and resource efficient access to information, improving learning environment for people. Internet tools facilitate people to access the information globally and processing, storing, transmission made easier in electronic form. Fig. 2 shows the Internet user in India is raised gradually.

- BIOTECHNOLOGY

The fields of biotechnology are a multidisciplinary nature and contain many scientific approaches on it. It began in 70"s with genetics and DNA technology. The genetic engineering is covers almost all areas including, Agriculture, Environment, Industry and Human Health. The application of biotechnology knowledge gives human kind the ability to alter the structure of life itself. The modern concepts like Cloning, Genetic Algorithm, Ant colony optimization, Swarm Optimization and Artificial Intelligence techniques are and new heuristics are developed on nature inspired plants and animals. Biotechnology techniques are boom for the human community and it depends on how it is used and controlled. The genetic engineering has got the industrial revolution when it was introduced and some the areas in which it perform well such as produce new and safer vaccines, treating genetic diseases, increase crop-yields, decrease

production costs, improve food nutritional values, develop biodegradable plastics and decrease water and air pollution

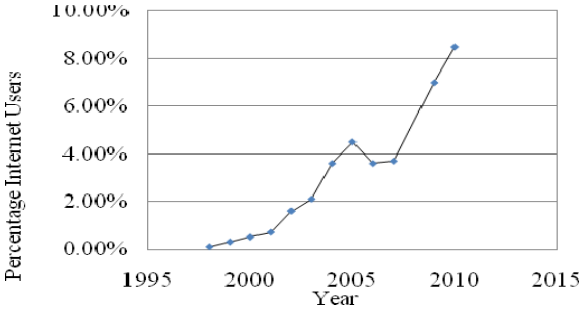

Fig. 2. Internet user growth in India source: www. Internet worlddstats.com

- SUSTAINABILITY IN THE AREA OF FINANCE

Access to sound technologies is essential for sustainable development. The investment decisions and transfer of technology are key vital part during trade. The imported technology has to be compromised, against the bargaining position . The vendor selection and selecting areas will safe guard the environment and enabling them to upgrade the human resources. The capacity building through technology acquisition, skill development and evolution of local policies and support for technology transfer process. The problems like market intervention of intermediation and matching technology with suitable applications, brokering partnerships, negotiations and devising financial packages. Replication or indirect effects must not affect the results and creation of such funds from includes: Project designs; through demonstrations, Resource mobilization, Improved regulatory frameworks and standards, Augmenting technical capacity, Devising new institutional models, and Encouraging stakeholder dialogues.

- SUSTAINABLE HUMAN RESOURCE MANAGEMENT

Human Resource Development is the important area for sustainable development of managing the human resources. Something from our own experience and some from experiences of others it's a way of transferring the knowledge and skill to offspring through grooming. Everyone expects their skill and knowledge has to be transferred to their offspring's and to become more respectable members of their societies. Some of the critical factors for sustainable HRD are the population explosion, the rising expectations and the ongoing knowledge revolution.

- SUSTAINABILITY ON IMMEDIATE TECHNOLOGY

The change in technology should not confuse with the technical changes that takes place

nowadays. Change is now necessitated by national and global environment concerns were that the need to the poor must be addressed. "…the major obstacle to the development of the rural poor is the so-called educated man."-- Bunker Roy, Indian Express, 1983. As social, economic and political problems increase in our technology-revolve world, it is important to inquire where we have gone wrong, and to seek alternative paths to sustainable development. Government of India issues from time to time lists of Industries "where foreign investment may be permitted". No doubt, a broad technology base has been created in the country, yet a need to update the production technology may arise due to constant technological advancements in developed countries .Government of India (foreign investment Promotion Board) may consider import of technology

- CONCLUSION

The need of the hour is to identify the key areas in the planning activity for sustainable development. Identify the present scenario of science and technology activities of developed countries. The isolated areas of particular research interest must be addressed for which the improvements could combine together and supports the lack of expertise for the individuals. The infrastructure developments on sustainability developments must be addressed with high sophisticated channels. Most of the countries have agriculture –based economies with the usage of sustainable technology the crop yields can be raised . So far the development on sustainable technology lacks behind in the areas of human resource development due to resistance to change, lack of awareness, and adoption of technologies using rapid technological development in all private sectors .

SCIENCE, TECHNOLOGY AND HUMAN RIGHTS

"…The moment man first picked up a stone or a branch to use as a tool, he altered irrevocably the balance between him and his environment. From this point on, the way in which the world around him changed was different. It was no longer regular or predictable. New objects appeared that were not recognizable as a mutation of something that had existed before, and as each one emerged it altered the environment not for a season but forever. While the number of these tools remained small, their effect took a long time to spread and to cause change. But as they increased, so did their effects: the more the tools, the faster the rate of change." --James Burke, *Connections.*

With the advent of science and technology the equations between man and his environment altered and went through massive upheavals. The science & technology played the role of both, the facilitator and the destructor. Initial push for scientific development was an outcome of the realisation that the means of livelihood are scarce and insufficient to meet the needs of rapidly growing population. Old traditional methods fell short to meet the needs and problems like food shortage, drought and famines became more acute. The Malthusian theory of population seems quite pertinent in this regard,[1]which put forth that "the power of population is so superior to the power of the earth to produce subsistence for man."

This left man with no alternative but to take recourse in science and technology to meet its end. With passage of time and breathtaking advances in field of science, technology and its application serious concerns were raised particularly about its impact on the human rights. Technology became dominant in all spheres of life and it was realized that the power of science & technology is unbridled and gives the person in command, the immense power over the other. Far reaching consequences were realized that were uncontrollable and unimaginable. The rapid proliferation of very sophisticated technology raked up very basic human right issues. Until now human rights issues revolved around the basic issues of freedom of thought and expression, right to inherit and manipulations and abuse of human rights by police and other agencies[2] but with technological revolution several issues evolved which were believed to leave the lasting imprints on human body, mind, environment and the human society.

[1] T.R.Malthus, in his famous book: *An essay on the principle of population*. 61,1798

[2] M.Chandrasekhran, "Human Rights and Bio-technology in the Twenty First Century"24 *C.U.L.R* 77 (2000).

Meaning and concept: Interplay between science, technology and human rights.

Before elaborating on the impact, let"s first analyze the meaning of the term science and technology. The word "science" according to Webster's New Collegiate Dictionary is "knowledge attained through study or practice covering general truths of the operation of general laws, especially as obtained and tested through scientific method and concerned with the physical world". The word "technology" on other hand means, the systematic treatment of an art, form or skill or a manner of accomplishing a task especially using technical processes, methods or knowledge. On reading the definition, one may presume them as naïve concepts but they are most powerful potentates which can alter the course of human life or rather challenge his existence on earth.

Thus it becomes all the more important to understand the interplay between human rights and science and technology. C.G.Weeramantry, in his article[3]said that the realization that science and technological power, like all other dimensions of power, must be subject to law came late. And by the time lawyers or law took it to task it had left them far behind in the race. By way of a simple illustration, he explains, the outmoded nature of legal concepts. He says that, the trespass, which was always perceived in physical sense, has somewhat different connotation in the technological era, where a person without stepping in to one"s house can tamper one"s personal information, his image and integrity. The growth in science and technology was exponential, which rendered new solutions outmoded even before they saw the light of day.

Need to study the impact.

As discussed above the challenges posed by the new technologies were phenomenal but what aggravated the problem was the growth of the big corporate houses who own these technologies. These corporate houses controlled the finances of nations by combining technologies with wealth and generated the consequences which were far beyond the individual expectations. Another dimension to this problem was that these houses were concerned only with profit making and invested vast amount of wealth in invention of new technologies completely sidelining the

[3] "Human Rights and Scientific and Technological Progress" in Janusz Symonides(ed.), *New Dimensions and Challenges for Human Rights* 243(2003)

human values. The invention of sophisticated warfare technologies paved the ground for alliance between the technology inventors and buyers. Technology ventured almost in all aspects of life (be it health, environment, reproduction and food etc.), and this interaction had less positive but more negative repercussions. The inadequacies of legal system to deal with the problems of technological advancement resulted in myriads of human rights issues.

 Initial concept of science and technology as a tool for furtherance of human and social welfare, scientific temper.

Initially as we progressed, the achievements of human resource development, technology development were considered as boon. The human rights instruments tackled the questions posed by advances in science and technology on human rights, human dignity and integrity from a positive point of view. The **Universal Declaration of Human Rights (article 27)** (1) acknowledging the advancements in scientific developments provided that everyone "has the right… to share in scientific development and its benefits". Similar language was found in **Art. 15 (b) of the International Covenant on Economic Social and Cultural rights** which confirmed, the right to enjoy the benefits of scientific progress and its applications and emphasize on full realizations of this right for development and freedom indispensible for scientific research. Even **Art.51A (h) of the Indian constitution** lays stress on developing the scientific temper, humanism and spirit of inquiry and reform.

 Debates over 'development': quality of life versus materialism.

It can be seen that in the early years of evolution of human rights, the possible dangers of scientific advancements were not articulated or not contemplated, whereas the need for more and more technology and science was unquestionably asserted. But eventually concept of right to development became a catalyst for realization of human rights. In **the United Nations Declaration on the Right to Development, 1986, the UN Declaration on Social Progress and Development, 1969 and the UN Millennium Development Goals, 2001** the development was put forth as a composite right, as a process, where all the human rights, civil, political, economic, social and cultural rights are realized. The „development" was deemed to be a comprehensive term that incorporated economic, social cultural and political process, and which aimed at the constant improvement of the well being of the entire population and of all individuals on the

basis of their active, free and meaningful participation in development and in the fair distribution of benefits resulting thereof. In 1993 at the **Vienna Conference** the right to development was acknowledged as a human right.

The term "development" was given a appropriate meaning that embodied an idea that that reaches beyond economic growth or the expansion of material wellbeing of the nation and of the peoples. As a right it was considered to involve the right to food, health, education etc, Debates over „development": quality of life versus materialism paved the ground for discussion among academia that unhindered and uncontrolled expansion of technology will not be allowed in violation of basic human rights under the garb of progress. The need was felt to control and circumscribe the technological advancement in the name of development.

 Recognition of the human rights concept in arena of science and technology

The fast and unbridled growth in arena of technology posed serious problems not only at domestic front but also at the international level. The problems were same but the intensity of problems was graver at the international level because at least at domestic front legislation could be done but at international level state seemed reluctant to subject themselves to regulations and norms. The recognition of the human rights concept in arena of science and technology can be studied under two heads:

 International Instruments

The international law was not ready to meet the challenges posed by the advancement in science and technology as a result it took time to respond. Also the states[4], had their vested interest in the particular technology which if come to be regulated under international would have hampered their interests. It is important to note that the question of the impact of scientific and technological developments on human rights was brought before the United Nations for the first time in 1968 as a result of an initiative taken by the **International Conference on Human Rights held in Tehran,** Iran.

Following the recommendations of this conference the General Assembly of the United Nations adopted a resolution inviting the Secretary-General to undertake "continuous and

[4] As C.G.Weeramantry puts in his article,"Human Rights and Scientific and Technological Progress" in Janusz Symonides(ed.), *New Dimensions and Challenges for Human Rights* 247(2003).

interdisciplinary studies, both national and international, which might serve as a basis for drawing up appropriate standards to protect human rights and fundamental freedoms." Specific attention was to be paid to developments in science and technology in relation to:

o respect for the privacy of individuals and the integrity and sovereignty of nations in the light of advances in recording and other techniques;

o protection of the human personality and its physical and intellectual integrity in the light of advances in biology, medicine, and biochemistry;

o uses of electronics that may affect the rights of the person and the limits that should be placed on such uses in a democratic society; and, more generally,

o the balance which should be established between scientific and technological progress and the intellectual, spiritual, cultural, and moral advancement of humanity

This resolution accentuated the dangers that technological developments harboured with respect to human rights and fundamental freedoms. The **Proclamation of Tehran** becomes relevant in this context as it laid down for the first time that the scientific discoveries and technologic advancements may endanger the rights and freedoms of individuals and would require continued monitoring. The Conference recommended in resolution XI, that the various organizations of the United Nations "should undertake a study of the problems with respect to human rights arising from developments in science and technology."

The General Assembly Resolution- The General Assembly of the UN on 19th December 1968 by Resolution 2450 (XXII), invited the Secretary General to undertake a study of the problems in connection with human rights arising out of developments in science and technology. Based on the recommendations a further report in the nature of a draft programme was prepared by the Secretary General which was placed before the Human Rights Commission in its twenty-sixth session in 1970. It led to Resolution 10(XXVII) of 18 March 1971 in which the Commission related the problem to the needs of the **Second United Nations Development Decade.** That same Declaration called upon all states to cooperate in the establishment, strengthening, and development of the scientific and technological capacity of developing countries with a view to accelerating the realization of the social and economic rights of the peoples of those countries.

The impact of technology has ranged from the peaceful penetration of useful technologies to what Dr Egziabher[5] has described as the "violent entry" of destruction technologies. In all this, the impact upon lifestyles that have been maintained for centuries, if not millenia, has been profound and widespread, a growing awareness of the problems at the interface between the expanding domains of technology and human rights prompted the General Assembly of the United Nations to proclaim in 1975 its **Declaration on the Use of Scientific and Technological Progress in the Interests of Peace for the Benefit of Mankind** (resolution 3384 (X X X) of 10 November 1975). This Declaration called upon all states to take appropriate measures to prevent the use of scientific and technological developments to limit or interfere with the enjoyment of human rights and fundamental freedoms of the individual as enshrined in the Universal Declaration of Human Rights, the International Covenants on Human Rights, and other relevant international documents.[6]

A decade later, Resolution 1988 of the Commission on Human Rights dealt with the use of scientific and technological developments for the promotion and protection of human rights and fundamental freedoms. It invited the United Nations University, in cooperation with other interested academic and research institutions, to study both the positive and negative impacts of scientific and technological development on human rights and fundamental freedoms.[7]

 Domestic Instruments

Deep concern was felt by the developing countries which paved the way for **'Poona Indictment'** adopted at a meeting of the World Order Models Projects held in Pune in July, 1978. The declaration called „Perversion of Science and Technology: An Indictment". It referred inter alia, drug testing among poor population, use of 50% research scientist in military research and development. In India we have **Art.51A (h) of the Indian constitution** lays stress on developing the scientific temper, humanism and spirit of inquiry and reform. Beside this India has struggled to keep pace with technological advancement, nevertheless it has legislation on pertinent areas

[5] Dr Egziabher has done detailed examination on firearms technology and its profound impact upon all aspects of Ethiopian social and political life has implications for all countries, especially in the developing world under the study conducted by UN, *Impact of Technology on Human Rights: Global Case Studies.*(United Nations University Press, Tokyo,1993).

[6] As quoted by C.G.Weeramantry in the introduction of the study undertaken by UN, *Impact of Technology on Human Rights: Global Case Studies.*(United Nations University Press, Tokyo,1993).

[7] C.G. Weeramantry (ed.), *Impact of Technology on Human Rights: Global Case Studies.*(United Nations University Press, Tokyo,1993).

such as **Pre-natal Diagnostic Techniques Act, 1994, National Organ Transplant Act, 1984, Environmental Protection Act, 1986, the Human Ethics Committee at the Rajiv Gandhi Centre for Biotechnology** operates in the framework prescribed by the Constitution of India as well the guidelines for research on human subjects set by the Indian Council of Medical Research and the Department of Biotechnology, Government of India, **the Information Technology Act** but at the pace which these technologies function it outmodes the laws which is posing great human right challenges in India.

- **Impact of science and technology**

C.G.Weeramantry, in his book, states that the spectacular advances in science and technology that have continued unabated have emphasized the urgency of the problems. He further states that, the urgency grows on two fronts - the scientific and the practical - and in combination these two factors which produce an exponential growth in the urgency and the magnitude of the problem. He says, the world for the betterment of the human condition can no longer ignore the problem since every step forward in science and technology, the power of these forces to affect human society for better or for worse has increased. With every passing year that power will increase and the need to use it in the interest of human rights will grow correspondingly more urgent. He further elaborates that the power of science and technology keeps growing, and the problems we are addressing will worsen. He illustrate it with an example, he says, given that the right to food and a pure environment is a recognized human right, the problems facing us today at the beginning of the 1990s are far more acute than they were in the early 1980s. Thus it becomes very important to peruse the role of science and technology and its impact on human rights. Science and technology is no longer the subject of a complacent assumption that they are synonymous with progress, freedom, and the betterment of the human condition. Consequently, the decisions associated with their adoption are no longer seen as neutral and value-free. Rather, they generate strong support or opposition, provoke emotional reactions, and, indeed, become political issues of considerable importance. The discussions surrounding these decisions raise sharply such issues as whether science and technology determine the course of their own development or whether society can and should control them. Answers that may suit one society

may not suit another. Human rights issues become inextricably interlinked with decisions regarding suitable scientific and technological models for a given society.

Positive role.

Science and technology offer the opportunity par excellence for generating "productive patterns of interaction among all members of the international community." Human right is a vital field of attention in the drive to improve the human condition. Such an improvement is, as the Secretary-General observes, a prerequisite for lasting peace. The advancement in science and technology has undeniably strengthen the human rights movement in the sense that right to food, right to health and education which has been recognized as basic human rights were a facet of development which was facilitated by science and technology. The best of medical and therapeutic techniques are available in human domain, the revolution like green revolution (high yielding variety of seeds, irrigation facilities and pest resistant manures boosted the food production) and white revolution (increase in productivity of milk via germ line engineering of cows) post 1960"s helped India to tackle problems like food scarcity which was the biggest problem post independence. Undoubtedly science and technology has fetched various material comforts which has led to personal well being such as improved accessibility in terms of transport facilities, availability of information(through net vast data can be generated) better medical facilities which has enhanced life and cured some of greatest human misery.

 Negative role.

In the midst of a growing scientific and technological capability, one can see desperate and destabilizing denials of human rights. Scientific and technological capability has grown to unprecedented proportions, and further delay can only be indulged in at the cost of lasting damage to the future of the race. The concept of dual use of technologies, impact of unbridled use of natural resources, development of means and methods of violence and war, new torture methods, methods of deprivations are some of the major issues which affects human rights since they hit at core of human dignity, integrity and well being which has recognized as basic human

rights. The negative impact of these technological advancements has been dealt under specific and pertinent human rights issues discussed below.

Major areas of concerns/ some ethical and legal issues

While addressing a problem as vast and grave as that of the interaction between science and technology and human rights, one has to be selective. Thus in this assignment, the impact of science and technology is dealt with in certain sub-heads that are of special relevance and are of immediate interest to vast sectors of the global population. The heads covered gives valuable insight, pertinent to the impact of technology on human rights.

 The Human body: Issues involved: right to life, human dignity, integrity

The Universal Declaration of Human rights talks about inherent dignity[8]freedom from torture and inhuman or degrading treatment[9] and right of free and full development[10]. The advancement in technologies has withered this concept of inherent dignity by encroaching upon his mental and physical make up. The growing concern for human rights has paved the way for setting of international bodies such as **International Bioethics Committee**, **Council for International Organizations of Medical Sciences**, **International Guidelines for Biomedical Research Involving Human Subjects**, **Universal Declaration on the Human Genome and Human Rights.**

 Development in bio technology

The biotechnological development has opened the gates for human experimentation, foetal experimentation, sale and hire of human organs, torture techniques, psychosurgery, and personality test, the use of untested drugs, genetic engineering, selective breeding and pre selection of sex. Sperm and ova banks, in vitro fertilization, embryo transplantation, foetus farms all raise important ethical and human rights issues.

[8] Article 1 of UDHR.
[9] Article 5 of UDHR.
[10] Article 29(1) of UDHR

Human cloning

The process of cloning indicates the taking of a cutting, and also includes nuclear transfer, of genetically identical animals. Nuclear transfer involves removing the chromosomes from an unfertilized egg and replacing them with nucleus from the donor cell. As it is the transfer of nucleus that determines almost all of the characteristics of the resulting offspring, a clone will resemble its parents, i.e. the animal from which the donor cell was taken. no doubt there is positive consequences such as coding for genetically inherited diseases and unresolved diseases for eg. early detection of cancer. But it raises number of ethical and human rights issues. Should the alteration of germ cells which results in a permanent genetic change for whole organism and subsequent generations be allowed? Does the reproduction of a clone organism from individual gene, successfully used to produce mice and sheep, be allowed in the case of human beings? How to eliminate the creation of „humoniods" (human inter- species hybrids)? These question touch the very essence of the being human, of dignity and integrity of the human person. Also it raise problems like bio piracy i.e., transportation of novel gene outside the country which is a concern to developing countries rich with bio diversity can be prevented to use them for their own benefit.

New reproductive techniques

The advancement in technology has been a boon for women who cannot produce off springs through traditional biological process. Now they can have test tube babies that can develop in womb of surrogate mother. The basic issue that it raises is that who is the mother, can child claim property of surrogate mother at any stage. Though they have more legal connotation, but it also rake up very fundamental human right issues. The concept of surrogacy is completely doing away with social heir phenomenon i.e., where couple who could not had their natural child would adopt but with advent of this technology, leave women incapable of producing, the fitter one"s (rich) could opt for something like rental mother to save themselves from pre and post natal discomfort. Another facet of technological development in reproduction techniques is artificial insemination, through which a women can have children without a legal male partner as husband through the instrument of marriage with help of sperm bank. It raises a very complex

problem as to who should be the real heir, the genetic heir or natural heir. Does it not violate the right of child to have family where he can secure love of both his parents? Also what can be done in situation where man decides to have a child not from his wife rather hire a rental mother? The artificial reproductive techniques hits at the core of the human right i.e., dignity, and can be used to destroy the basic social fabric.

 Human performance augmenting drugs

Human performance augmenting drugs and technologies such as use of steroids in sports, hormones, viagra raises certain issues. The composition of these drugs is beyond educated person"s understanding. The side effects of these drugs are not mentioned by the big pharmaceutical giants which results in hormonal imbalances, depression and impulsive behavior and long and persistent use causes addiction and health deterioration which is a basic human right.

 Life sustaining technologies: euthanasia

Medical advancement in the beginning concentrated on life augmentation but now the same technology is being used in administering death. A lethal drug injection through doctor"s assistance is viewed as a way to end the plight of patients who are in coma or leading machine assisted life. Such people are called burden and family and friends wants to wash away their hands from their responsibility. Euthanasia is now hotly debated, the human right activist stress on preservation of life and condemn doctors assisted suicide whereas some feel it is sheer wastage of money since they will never come back to life. Euthanasia raises the question that whether right to life is fundamental or do we make doctors god who can seal the fate of such patient.

 New torture technologies

New torture technologies such as electric shocks, trauma inducing drugs and psychotropic drugs have raised serious concerns among human right activist. Narco analysis test, brain mapping and psychosurgery were the subjects of much abuse until recently. Among the new instruments of

torture, are drugs which induce certain psychological reactions such as horror or fear or disorientation, and finely -graded electrical shock. There is also pharmacological torture, which can cause temporary paralysis. The basic premise of law on which criminal justice system rests is presumption of innocence until proven guilty but these techniques have shaken this very basis. Article 5 of the UDHR, article 7 of ICCPR and Convention on the Protection of All Persons from being subjected to Torture and Other Cruel, Inhuman or Degrading Treatment of Punishment, 1984 prohibits degrading and inhuman torture.

 The Human society: issues involved right to life, to know, peace and health

The technological advancement has affected all dimensions of human life. The societal interest has been jeopardized in the sense that new domain of information exchange presupposes dissemination of proper information. The right to information determines other set of rights such as right to health since incomplete information can cause perils to human life.

 Access to information, controlled thought and expression

The new information technologies have strengthened the global dissemination of information. It has enhanced connectivity and uplinked the nook and corners of the worlds. One can have access to all libraries which has helped researchers world over. But it has also created problems like right to privacy. Now, one really don"t need to physically encroach rather he can do it via cyberspace and hamper the life of person whose right has been breached. There are problems like piracy and violation of copy right. Internet is also used for dissemination of pornography, for promoting racism, xenophobia and terrorism etc. The International Congress on Ethical, Legal and Societal Aspects of Digital Information held in Monaco in1997 has proposed creation of Commission on the Ethics of Scientific Knowledge and Technologies.

 Genetically modified food

Science and technology has enhanced food production, diversified food production and storage and food security. The Universal Declaration on the Eradication of Hunger and Malnutrition, 1974 and UN Millennium Development Goals (2001) drew attention to subsisting problem of food shortage which led to advent of bio technology in agriculture. Genetically modified food and its implication has led to debates such as BT brinjal. Till now BT cotton was used world

over, but recently it was discovered that it led to extinction of monarch butterflies in America. Genetically modified food involves the basic human right to life since various scientist claims that genetically modified food should not be allowed since the repercussion are still under survilance.

Means and methods of warfare.

The means and methods of warfare such as nuclear weapons and biological weapons can completely wipe of human species. The very existence of human is in jeopardy what to talk about dignity and integrity. Despite the UN Declaration on the Use of Scientific and Technological Progress in the Interest of Peace and for the Benefit of Mankind, 1975, the sword of war is still in air. The history has witnessed the Hiroshima and Nagasaki bomb Dropping and is aware of repercussions of nuclear warfare, but still nations are still busy spending billions of money on developing more sophisticated weapon technology.

 The Human environment

The degradation of environment is very vast topic. In fact the worst impact of technological growth has been on environment. Problems such as depletion of ozone, deforestation, acid rains, desertification, water, air and land pollution, extinction of diverse flora and fauna are out product of unhindered technological and scientific advancement. Discharge of toxic and radioactive wastes hits at the very basic human right of life. The World Health Organisation estimates that nearly 75-85 % of cancers are triggered by environmental agents.20 The Stockholm Declaration on Environment and Development, 1972, Agenda 21 Convention on Bio Diversity and other documents of the Rio World Summit on Environment and Sustainable Development, 1992 has suggested the gravity of the problem with relevant solutions so that human race can survive on this earth.

 Conclusion

Each facet of science and technological development offers a variety of problems. They pose grave threats which do not only hamper human rights but entire human civilization. Despite this

they present some of the greatest possibilities available to any generation to play an active role in shaping the human future. C.G. Weeramnatry in his book21 says this is a time of the confluence in human history of far-reaching forces that are in apparent opposition. Two of the most powerful are the power of science and technology and the ideological power of the human rights concept. Neither of these has at any time in history enjoyed the power it now enjoys. The first can undermine if not destroy the second. In combination, they can represent a phalanx of power for human betterment such as history has never seen. Studies of the way in which they can be drawn into mutual cooperation rather than confrontations are among the most vital that can engage our attention at the present time. The solution does not lie in negating the benefits of science and technology and also not in overlooking the perils but to shape up technological development in path illuminated by human rights. A true sustainable development, the fruit of which can be enjoyed by generations to come.

TOPIC NO. 2

SCIENCE - TECHNOLOGY AND RELATIONSHIP WITH LAW

SCIENCE, TECHNOLOGY AND LAW[11]

The Inter-disciplinary approach

For men and women who, in their daily life, pursue only one field of study it is refreshing to cross over its boundaries and to have a look at wider horizons. Such activities, covering as they do the boundaries of more than one discipline not only widen one's mental sweep, but also lend it depth and content. If science is the accumulated knowledge of centuries, law can be rightly described as collected wisdom of the ages.

Men have risen above the animal level, very largely by means "technics", the use of tools and implements for better procuring the mate means of life. Similarly, when they have achieved a reasonably perfect lei system, they have risen on the intellectual plane. A legal system is intended represent a synthesis of conflicting interests. Knowledge of the material world; its purest form is science, and when put to practical use, it becomes technology. Wisdom, at the peak of its excellence. is the foundation of the ideal political system, and, when utilised to regulate human relationships, becomes law Herbert Spencer defined Science as organised knowledge.[12] Law could be described as the wisdom of organised society given expression in binding rule by the State. "Law is a form of order, and good law must necessarily mean good order", Aristotle‟s saying[13] possesses as much validity today as when he wrote.

SCIENCE AND LAW

The points of similarity

[11] P. M. Bakshi Formerly member, Law Commission of India
[12] Herbert Spencer Education Chapter 2
[13] Aristotle, Politics, Book 7, Ch. 4, S.5.

There are certain other points of similarity between science and law. For example, science itself is organised on the same basis as law. It has been said[14]

"Art, in its legal significance, embraces every operation of human intelligence, whereby something is produced outside of nature; and the term 'science' includes all human knowledge which has been - generalised and systematised, and has obtained method, relations and the forms of law."

In science, general principles are formulated on an observation of specific phenomena. So it is in common law. It was said long ago that a precedent embalms a principle.[15] The famous letter writer[16] Junlus said that one precedent creates another, "They soon accumulate and become law". One need not therefore postulate a conflict between science and jurisprudence. Such has not been the experience of history. The two disciplines have flourished together, and have often been enriched by the same brilliant minds. For example, the golden age of Greek science the fifth and the fourth centuries before Christ was not only the golden age of Greek literature and art, but also the golden age of philosophic speculation. The fourth century was dominated by two of the greatest personalities of their kind in the whole past. The earlier half was dominated by Plato: the second half by Aristotle. Plato not only speculated about political[17] and legal topics,[18] but was also a great lover of mathematics. On the portals of his Academy, were inscribed the words- ""Let them not enter here who do not know Geometry".

Aristotle was not only a pioneer in the natural sciences; he also wrote extensively on constitutional and legal topics.[19] The life and writings of these two brilliant minds show that deep and extensive knowledge of the world of nature can reside together with insight into law, social sciences and jurisprudence. There is no anti-thesis between science and law.

The progress of science

Science in the twentieth century has become big, complex, and expensive. It has also become relevant to the ordinary lives of men to an unprecedented extent. One could say, without too much exaggeration, that the course of history since the last quarter of the nineteenth century has been a story of increasing acceptance and incorporation of the scientific knowledge and scientists

[14] Atchison & C.R.R. Co. v. U.S. 15 Court of Claims (per Davis J.); Sarkar Evidence (1971), page 496

[15] Lord Stowell, opinion given as Advocate-General, 1788
[16] Junius, Letters; Dedication
[17] Plato, The Republic
[18] Plato, The Laws
[19] Aristotle, Politics

into the practical institutions of society, including both business and government. Science has become involved in our domestic politics, In international relations, and in virtually every institution which vitally affects men in the mid-twentieth century.

A Cornell University scientist caught the mood perfectly[20] when he observed that one of the most surprising outcomes of the war had been the sudden and I believe permanent-enthronement of science in the activities of humanity".

Let us note some examples. Human labour and education may be revolutionised by computers. The achievements of medicine and surgery in the prolongation of life may alter the very concept of life. New developments in the processes involved in the creation of life may also raise interesting problems. A scientific discovery or a technological invention could be a threat or a promise. it is for society to decide which one of the two it shall be.

Science itself has changed beyond recognition. Centuries of careful observation and beautifully creative thought went into the ancient Greek conclusion that Earth was at rest in the centre of the universe, with the sun, the planets, and the stars rotating about in circles and epicircles. What could be more logical? We do not feel any sensation of the earth's rotation, and a circle is the most perfect of figures. The theory was explained and defined with great precision during the second century by Ptolemy of Alexandria, but, unfortunately, in doing so, Ptolemy sterilized astronomy for some thirteen centuries, until the miracle of Nicolaus Copernicus.

Tennyson told us that science moves but slowly. This may not be literally true today.

But it does seem that in science - as perhaps in many other departments of human civilisation - there is a "time-clock". The hour struck sometime ago for psychology. It may strike now, for biological sciences, since they have reached a point at which they would be in a position to throw light on many fundamental questions.

The role of science should not be disregarded. The great advances in scientific knowledge, the speed at which scientific developments proceed, the enormous part played by applied science in the life of a modern community and the degree to which our progress depends upon it, highlight the importance of a wider appreciation, among the people, of scientific principles and procedures and their impact on society.

The march of law

The law also has had its share of complexity in the course of centuries. Many of the important

[20] Quoted by George H. Daniels, Science in American Society (1971), page 293

features of the Anglo-American legal system were established prior to the great industrial expansion. The enormous economic political and social changes of the past one hundred years have been accompanied by corresponding changes in our legal system. As the we became a pre-dominantly industrial and urban society, as the "big business" corporation emerged and labour was organised, as communications developed to create a world market and a world culture, as population doubled and quadrupled, the law inevitably became far more complex; and at the same time, it became more systematised and more rationalised.

CLASSIFICATION OF SCIENCES AND THEIR IMPACT ON LAW

Science is conventionally divided into certain main branches. The usual distinctions between sciences depend on tradition and convenience in teaching and research. There is the exact and non-empirical science of mathematics. Then, among empirical sciences, there are

(1) physical,

(2) biological,

(3) human and social sciences. It is convenient to separate physics and chemistry, so far as different equipment in different laboratories is required.

Even so, there is interconnection and overlapping. Medical sciences are human and social, as well as biological and physical; particularly when they use special physical methods (e.g. medical radiology).

Scholars make a distinction between “science" and “technology". All sciences developed out of “technics"; mathematics developed from measuring goods in the market, keeping accounts and surveying land; astronomy, from compiling the calendar; mechanics, from working wood, stone and metals, and from construction of buildings and transportation by land and water, chemistry, from smelting metallic ores, brewing, distilling and dyeing; biology, from hunting and agriculture; and so on. But no technical achievement, however great, has by itself produced genuine science. Genuine science was the work of the Greeks of the 6th and 5th centuries B.C. (Thales and his school, the Pythagoreans and their successors). They first released human thought from the “pursuit of utility on the one side and fantasy on the other, in order to make a systematic attempt to understand the natural world. Their most conspicuous success was in mathematics, as a result of generalising problems and discovering methods of proof. Others, in Egypt and Mesopotamia, had discovered particular solutions for particular problems, some quite difficult, - presumably by trial and error; but they could not distinguish an exact from an approximate

solution, nor even be sure that an apparent solution was not a lucky accident. The Greeks could do these things, and, by solving a general problem, solved at one stroke a multitude of particular problems.

The development of law offers a somewhat similar parallel. Particular instances are first dealt with, and, in course of time these give rise to general principles drawn from those cases. By enacting a general and universal rule, for example, legislation at one stroke covers a multitude of particular situations.

LAW, SCIENCE AND TECHNOLOGY

Social evolution, and biological and technological progress, must, of necessity, be accompanied by changes in legislation, particularly in penal law; changes in the sense of modernisation and reform. Social evolution and scientific advancements may be summarised as follows:

(1) Those in the political and governmental sector;

(2) those in the socio-economic sector;

(3) those in the social family sector;

(4) those in the medico-biological sciences;

(5) those concerning the use of new types of energy;

(6) those in the socio-cultural and the socio-ethical sector.

All these aspects concern man. The social sciences, too, have made these aspects substantial progress.

Science and law Points of contact

The points of contact between science and the law are numerous. The evolution of scientific theory, research and development might in the first place, affect the substance of the law, inasmuch as there would arise the need for dealing with so many spheres of nature and the human mind which have been explored by science.

Secondly, the process of law may have to take into account scientific developments. The adjective law-the law of procedure and evidence-is often felt to be in need of modification in the light of scientific developments.

Thirdly, in the actual administration by courts and other authorities entrusted with judicial and quasi-judicial functions, advantage could be taken of new scientific techniques that might be useful in court administration. A meaningful dialogue between the two disciplines is not a luxury; it has its utility, and it may soon become a necessity.

The rapid growth of science both in regard to the variety of fields covered and the intensity of knowledge acquired, might, in the not distant future, compel a close consideration of the subject of the inter-relationship of the two disciplines.

Francis Bacon once observed, "He that will not apply new remedies must expect new evils" We could avoid the emergence of new evils by anticipating them and by devising appropriate solutions.

Past responses

It would not, however, be correct to say that the law has been totally oblivious of scientific developments. The history of legislation in most civilised countries, at least since the time of the industrial revolution, shows that as and when new problems were presented by technological change and by its impact on human beings, the law, sooner or later, did take note of the fact and performed its role of "social engineering", by evolving suitable rules to regulate the conduct of human beings in the light of those developments. Whether this result was achieved by legislation or by the judicial process (the method of the common law) or by any other method, is a matter of detail. But the fact remains that the problems came within the *fold* of *the* law. *For example, when animal transport* are *to* be *replaced* by *rail* and *the question* arose of *the liabilities* created by railway operations, legislation regulating railways was enacted.

At common law, where a railway is constructed and worked under statutory powers, and there is negligence in the construction or use of locomotives, there is no liability for fires caused by the escape of sparks from locomotives, although there is such liability if the railway is not worked under statutory powers.[21] But this view was rather hard upon farmers who had crops adjacent to a railway line. Accordingly, a compromise was effected by the Railway Fires Act, 1905, and 1923, which cast upon railways a liability not exceeding pounds 200[22], for damage caused to agricultural land or agriculture crops for fire arising from the emission of sparks or cinders from their locomotives, although the locomotive was used under statutory powers.

Same was the case with invention of the telegraph, the telephone, wireless telegraphy and aircraft and discovery of the atomic energy. Each of these developments in the scientific field was followed, if not accompanied, by legislation that was intended to settle problems caused thereby.

[21] Vaughan v. Taff Vale Rly. (1860) 5 H. & H. 679; Jones v. Festiniog Rly., (1868) l.r. 3 Q.B. 733; Rylands v. Powell v. Fall, (1890) 5 Q.B.D. 997; Mansell v. Webb, (1918) L.J.K.B. 323

[22] Railway Fires Act, 1905 and Railway Fires Act 1923, 5 Edw. 7, c. 11, S. 1; 13 & 14 Geo. 5. c. 27. s. 1

The dangers inherent in the setting up of nuclear installations- atomic, energy, radio-active substances, the emission of ionising radiations, the use of radio-istopes for medical and industrial purposes, and the disposal of waste therefrom-created new problems of liability to which the common law, in the form of actions for negligence, nuisance and the rule in *Rylands v. Fletcher,* provided no satisfactory answer. Only legislation could deal with the matter.

Adjective law and Science

Adjective law also furnishes illustrations of the legal approach to science. The fact that science (in the sense of specialised body of knowledge in a particular discipline) is primarily a matter for the experts, has been recognised by the law for a long time. It is precisely on this basis that section 45 of the Indian Evidence Act, 1872-an Act which is now more than a hundred years old-allows experts to give evidence of their opinions. Initially, the law was reluctant to admit in evidence the opinions of "experts", because of the traditional rule that evidence could be given only of facts which can be perceived by the senses, and not of opinion. But adherence to this strict doctrine was soon found to be unrealistic, when the matters of which evidence was to be given were themselves such as could .not be perceived by the ordinary human being without the aid of specialised mental and physical equipment.

Pace of the modern developments

Where, then, do we find the peculiar impact of science on law in modern times? In answer to this query, it may be stated that the peculiarity lies in this-that the points of contact between science and the law have, in modern times, increased in their number and intensity.

Each year brings a fresh crop of scientific discoveries. Knowledge that was accumulated a decade ago becomes out of date. Fresh fields are trodden, fresh avenues explored, fresh phenomena unearthed every year. These discoveries and explorations increase not only in quantity and number; they touch individual and social life at so many points. These are the points that ultimately become the points of contact between science and the law. It is in this manner that scientific developments result in an increase in the need of legal response to the various points of contact.

A country would be able to deal with this situation satisfactory to the extent to which its legal machinery that is to say, the machinery concerned with the formulation, administration, interpretation and re-formulation of the law,- takes adequate steps wherein the legal response referred to above finds Its reflection in a satisfactory manner .

Certain scientific techniques could be abused. Need to protect indlvidua1 liberty against unwarranted interference with privacy, which is technically possible, is an example of the need to create legal protection against abuse of technology. It may be elementary, but it is worth pointing out that the law acts only on human beings, and is concerned only with the conduct of human beings. It is not therefore every scientific development that may create legal problems. For example, the purely scientific discoveries have been revolutionary - discovery of X-Ray (Roentgen 1895), psycho-analysis (Freud 1900), Mendelism (1900), radium (Curie 1903). But these did not rise any socio-legal problems. On the other hand, disintegration of the atom (Lord Rutherford 1919) had important consequences in the course of time.

Legal response to technology is not new. The greatest events of the 15th century were the invention of typography about the middle of that century and the geographical discoveries initiated by Henry the Navigator, reaching a climax at the end of the century with Columbus and others. These geographical discoveries continued during the 16th century and immeasurably increased human experience in many directions.

The invention of printing led to a far greater diffusion of ideas than had been possible before it. For the first time, the progress of knowledge could be registered fore ver as soon as it was made, standardised and transmitted to every corner of the civilised world. The discovery of printing was so pregnant that it is well to consider it as the beginning of a new period. Printing, and the abuses regarded as likely to result from a wide dissemination of ideas, led to regulatory measures in law. Many of these measures were politically controversial and some have passed into the oblivion of history. We are riot, however, concerned with their merits. We are concerned with those measures as illustrating the response of the law to technology.

Recent Scientific Developments

During the last two decades or so, there have been certain scientific developments and technological inventions that require regulation in the interests of society and to prevent abuse. The emergence of multifarious devices that permit a prying into the private affairs of men and women through what has come to be known as “electronic surveillance" and similar other devices, has led to a move in many countries for the enactment of legislation to regulate them. The question is essentially one of the protection of the personal integrity and privacy of the human being from the abuse of technology.

There is one important technological development that has not yet been attended to effectively

by society and law. With growing urbanisation and the mechanisation of transport, the number of road traffic victims is gradually increasing. While the law has devoted its attention to certain aspects-preventive, penal and compensatory in respect of accidents on the road caused by motor vehicles, much more remains to be done by society.

The measures to be adopted may not necessarily be legal. But they do require an inter-disciplinary study. There is a limit beyond which punitive, or even curative, action may not succeed. Preventive measures should be thought of more seriously than they have been thought of so far.

Difficulty of framing laws

It should not, however, be overlooked that sometimes it is not easy to formulate in precise and detailed terms the legislative response to a new scientific or other development affecting human beings.

The subject of experimentation on human beings provides a good example of the difficulties involved in framing legislation. Such legislation as has been enacted on this subject in some of the countries is restricted to limited areas, such as drug research or conditions for the allocation of grants. It has been found more expedient to regulate the matter by a code of ethics or other documents framed by the professional bodies rather than by legislation. The general consensus is that it could even be dangerous to issue legislation in this respect, since this might hamper progress in medical research. At the same time, there is a growing concern in some countries on this subject. The main reason for the difficulty in issuing legislative provisions is the fact that it is extremely difficult to take into account the numerous different parameters which have to be considered. There is the problem of benefit versus risk. Are the risks of experimentation balanced by its benefits? Then, there is the problem of differentiation between patients and normal volunteers. How far should experimentation with patients be allowed with or without their consent? Most important is the problem of consent, the quality of the investigator or of the institute and the equipment used and a host of other considerations. Rigid regulations, (with legal sanctions attached to their breach) may do more harm than good in this field. That feeling accounts for the cautious approach shown in the matter. The fact that the most vital human interests are at issue lends a delicacy to the subject.

From the realm of life sciences, one could draw another illustration. A question which raises important ethical problem is the definition of death and the appropriateness of laying down

criteria in this respect in legal documents. While the classical definition of death-namely, the arrest of heart and respiratory functions- remains valid, we know that the transplantation of organs, especially those organs which have been called „critical organs', has given rise to new problems. Learned discussions have been devoted to the subject; but legislation has not, in general, been found advisable. The question remains whether criteria of irreversible „brain death' have to be formulated in legislation. On comparing the criteria formulated by law in different countries, it appears that these are - rather divergent. One wonders if, under these circumstances, it would not be better to limit the criteria to some sort of guidelines for the use of those who have to certify death in relation to transplantation. It is interesting to quote in this respect one of the sentences of the Sydney Declaration, which states that "No single technological criterion Is entirely satisfactory in the present state of medicine, nor can any technological procedure be substituted for the over-all judgment of the physician".

The number of studies made on the subject shows the interest of society in the matter, as also the difficulty of framing a law.

Ethical value judgments

Many fields of social life are imbued-with strong ethical value judgments, having their origin in religious background, historical tradition, climate and level of development of civilisation. These value judgments would vary among different societies. For example, in German law, a party is liable for damages for breach of contract only in case of *culpable* non-compliance with the contractual

obligation, while Anglo-American law, in this particular case, imposes what may be called an objective liability.

Another important aspect to be noticed is that facts requiring or suggesting the need of legal regulation may yet leave scope for the adoption of several possible alternatives. All these factors illustrate the difficulty of framing legislation.

The realm of ideas

Increased scientific activities result in tremendous increase in „ideas'. Technological developments, and the increased complexity of business, have made ideas more important and valuable than ever before. At least, people have been stimulated to produce them. Consequently, there arises a demand for legal protection for ideas. The withholding of legal recognition to those persons who have supplied „Ideas' would, on the hand result in a mounting number of injustices.

Justice as administered at common law does, however, sometimes bear a quantitative aspect. If, with reference to a certain type of claim, the job of screening out the cases built on a false foundation appears difficult or subject to possible error, the courts may not undertake that job, if it appears to the court -that only a few worthy claimants will suffer. If, however, the number of worthy claimants is very large, the judiciary may perhaps be inclined to face the difficulties and to take more chances.

Impact on administrative law

It is a peculiarity of scientific developments that if they are of such a nature as to require intervention of the law in the shape of legislation, then in many cases the legislation would contemplate an elaborate administrative set up. Administrative law deals with the power, procedure and liabilities of the administration; and regulates the manner of the exercise of various authorities and discretion by those authorities, public officers and other instrumentalities of the government. It also brings the administrative processes in accord with law and seeks to control the exercise of administrative discretions and regulations. Thus administrative law relating to scientific advising must concern itself with the extent and scope of the quasi-legislative and quasi-judicial powers of the administrative agencies. In the event of misuse or abuse of power and discretionary the administrative authority, it provides for review of administrative action, its rectification and. if necessary, judicial control. Within its province falls the question of constitutionality of delegated legislation and the legality of the rules, regulation and orders of the administrative agencies.

Protecting the products of the mind

When knowledge increases, ideas multiply and the question of their legal protection arises. There are, of course, several well-recognised legal spheres of protection for the products of the mind, the law relating to patents and inventions, the statutory law of copyright, and the law of literary property. But the ideas sometimes are not of such a nature or in such a form as to bring them within any of these categories. They may not be patentable subject matter, either because they do not fall "within the categories enumerated in the relevant statute, or because they constitute only general ideas which, however valuable, are not sufficiently reduced to a physical embodiment to bring them within the concept of „Invention'. The growing recognition of 'property' in ideas-either by Judge-made law or by legislation is an example of the response of the law to expanding intellectual horizons.

Copyright is concerned, of course, only with the expression of ideas. If an idea is set forth in writing, the one to whom it is submitted may be liable if, without consent, he copies the writing or makes unfair use of it in producing another expression of the Idea. This is taken care of by the law of copyright.

The law of copyright has, however, no application when the idea itself has simply been put to use without there being a written record. A question that has proved most controversial is, whether there should be protection for any ideas outside the traditional categories for their unauthorised use. The older cases are very strict in asserting that there is none. Within the last twenty years, however, there has been a tendency towards liberalisation of the law in this regard. Breach of confidence and similar heads of liability are being canvassed.

This shows how wide could be the ambit of possible legal responses to scientific developments and their consequences, and how intricate could be the - process of finding solutions thereto.

Science In the service of law and society

All in technology is not evil. The law should not be blind to such scientific developments as could be effectively and conveniently utilised in aid of the legal process. To take a very homely example, the typewriter, invented in 1873, is now to be found in every office. But its utilisation by the courts has not been so quick and universal as it could have been. Take next, the use of computers in the field of legal research. Computers have now come to stay in industrial and commercial life, but their use in the legal sphere is limited to very few areas. This may be partly due to the fact that the two disciplines-computer technology and the law-have not yet met each other across the table and established familiarity. Their acquaintance, if any, is a nodding one. Such a process of deriving benefits from science need not be confined to the physical or biological sciences. There is enough scope for applying social sciences as well. Sociology, for example, can be pressed into service in study of the administration of criminal law-particularly, in judging the effectiveness of criminal law.

In general, crime is a reprehensible behaviour; but the problem lies in the proper attitude of society towards reprehensible behaviour. It is here that the factors which are related to the moral judgment could be studied. For example, is sex a material factor in moral judgment-what kinds of offences, if any, are regarded more severely by man than by women? Does age make a difference? Has religious belief any impact? What about urbanisation, race, level of intellectual development and upbringing? These questions are the meeting points of psychology, sociology,

anthropology and jurisprudence.

Reference was made above to the invention of printing. The debt which the law owes to printing is immeasurable. But for the printed word, it would have been difficult to preserve the wealth of case law for the use of future generations of lawyers.

It is thus evident that the law, sooner or later, has taken note of scientific developments in the past, and should continue to do so in the future.

When future historians[23] look back at the period in which we are now living, they are likely to see it as a time in which scientific knowledge emerged from its, adolescence to become a major factor in the affairs of human societies. They will notice the problem that is posed for scientists and society alike and, with the benefit of hindsight, will pass judgment on the extent to which we took the measure of its significance. In this connection, they will pay particular attention to the grasp we showed in dealing with a new element in the situation-that of relating scientific knowledge to public policy-and, actions speaking louder than words, to the way we shaped our arrangements to this end.

Methodology of study

This brief outline of the points of contact between science technology and law, shows the very wide areas open for study. Since the subject of Interaction of science and law is a vast one and embraces so many fields of human activity, it may be wise to select certain important or pressing areas for study

It is a custom in science and perhaps a principle to select from the infinite reservoir of unsolved problems only those simple ones whose solution seems possible in terms of available knowledge and skills. We are also trained to subject our results to the most severe criticism. Adherence to these two principles- the

principle of selection and the principle of adherence - result in our knowing very little, but on the other hand, being very certain we really know this little.

In this context an important tool of research developed by science may also be taken note of. In general, the exchange of scientific information does not know of national barriers. Important scientific research conducted in one country travels to other countries within reasonable time. Unfortunately the same cannot be predicted of information relating to the law. This is, of course, partly due to the fact that the content of the positive law varies from country to country, while the

[23] James A. Shannon. Science and the evolution of Public Policy, (1973), page 31.

content of scientific knowledge does not so vary. Nevertheless, there is scope for adopting the comparative method to some extent. “All perception comes from comparison", said Novalis.

The tree of knowledge has so many roots and branches. It will not be easy to encompass all of them. It would, therefore, be wise either to select one branch of science or technology and study its inter-relationship with law. Or, as an alternative method, it would be desirable to select one branch of law and study its inter-relationship with science.

Conclusion

It is a legitimate task of the law to consider the social merits and demerits of scientific or other development and regulate human conduct.

Knowledge makes us free, but it can also be a danger for man. After all, it was the serpent that caused man to eat from the apple of knowledge and forego paradise. We cannot, however, reverse the progress of knowledge. We can only deal with the risk created by abuse of knowledge.

It is the task of the law to guide and shape the world, and to deal with the dynamics of technical developments and their effect on human beings.

When Newton bound together in one dazzling synthesis the great and the little, the stars in their courses and the fall of an apple, a thankful generation, at once scientific and pious, could exclaim with its spokesman, Pope:

“Nature and Nature's Laws lay hid in night:
God said, *Let Newton be:* and all was light:"

TOPIC NO. 3

PRIVACY LAW AND TECHNOLOGY

Privacy, Law and technology:

I Introduction

The right to privacy is a multi-dimensional concept. In modern society right to privacy has been recognized both in eyes of law and in common parlance. Article 21 protects the right to privacy and promotes the dignity of the individual. In recent years there has been a growing fear about the large amount of information about individuals held in computer files. The right to privacy refers to the specific right of an individual to control the collection, use and disclosure of personal information. Personal information could be in the form of personal interests, habits and activities, family and educational records, communications (including mail and telephone records), medical records and financial records, to name a few. An individual could easily be harmed by the existence of computerised data about him/her which is inaccurate or misleading and which could be transferred to an unauthorised third party at high speed and at very little cost. This growth in the use of personal data has many benefits but it could also lead to many problems.

Further, the convergence of technologies has spawned a different set of issues concerning privacy rights and data protection. Innovative technologies make personal data easily accessible and communicable. There is an inherent conflict between right to privacy and data protection. Data protection should primarily reconcile these conflicting interests to information. But, the data of individuals and organizations should be protected in such a manner that their privacy rights are not compromised.

II Concept of privacy

The terms privacy and right to privacy can't be easily conceptualized. It has been taken in different ways in different situations. Tom Gaiety opined that 'right to privacy is bound to include body's inviolability and integrity and intimacy of personal identity including marital privacy.' Jude Cooley explained the law of privacy and has asserted that privacy is synonymous to 'the right to be let alone'. Edward Shils has also explained privacy as 'zero relationship between two or more persons in the sense that there is no interaction or communication between them, if they so choose.' Warren and Brandeis[4] have very eloquently explained that ' once a civilization has made distinction between the "outer" and "inner" man, between the life of the soul and the life the body…the idea of a private sphere is in which man may become and remain himself.' In modern society privacy has been recognized both in the eyes of law and in common parlance. But it varies in different legal systems as they emphasize different aspects. Privacy is a neutral relationship between persons or groups or between groups and person. Privacy is a value, a cultural state or condition directed towards individual on collective self-realization varying from society to society.

The Indian Constitution provides a right to freedom of speech and expression,[24] which implies that a person is free to express his will about certain things. A person has the freedom of life and personal liberty, which can be taken only by procedure established by law. These provisions improvably provide right to privacy to individuals and/or groups of persons. The privacy of a person is further secured from unreasonable arrests, the person is entitled to express his wishes regarding professing and propagating any religion. The privacy of property is also secured unless the law so authorises *i.e.* a person cannot be deprived of his property unlawfully. The personal liberty mentioned in Article 21 is of the widest amplitude and it covers a variety of rights which go to constitute the personal liberty[25] *viz.* secrecy,[26] autonomy,[27] human dignity,[28] human right,[29] self-evaluation,[30]

[24] Constitution of India, art. 19 (1)(a)
[25] *Kharak Singh* v. *State of U.P.* , AIR 1963 SC 1295 & *Govind* v. *State of M.P.,* AIR 1975 SC 1378.
[26] *Allgeyer* v. *Louision,* 165 U.S. 578 (1897).
[27] Louis Henkin, " Privacy and Autonomy"74 *Columbia Law Review* 1410(1974).
[28] *Olmstead* v. *U.S.,* 277 U. S. 438, 478 (1928) & *Maneka Gandhi* v. *Union of India,* AIR 1978 SC 597.
[29] Universal Declaration of Human Rights, 1948, art. 12 & International Covenant of Civil and Political Rights, 1966, art. 17.
[30] Alan F Westin, "Science, Privacy and Freedom" 66 *Columbia Law Review* 1003 (1966).

limited and protected communication, limiting exposure of man *etc*. And some of them have been raised to the status of fundamental right, *viz* life and personal liberty, right to move freely, freedom of speech and expression, individual and societal rights and are given protection under article 19. Article 21 as such protects the right to privacy and promotes the dignity of the individual. Privacy relates to ability to control the dissemination and use of one's personal information.

Judicial activism: Right to privacy

Judicial activism has brought the right to privacy within the realm of fundamental rights by interpreting articles 19 and 21. The judiciary has recognized right to privacy as a necessary ingredient of the right to life and personal liberty. The Supreme Court of India has interpreted the right to life to mean right to dignified life in *Kharak Singh* case, especially the minority judgment of *Subba Rao* J. In *Govind* v. *State of M.P.*, Mathew J delivering the majority judgment asserted that the right to privacy was itself a fundamental right, but subject to some restrictions on the basis of compelling public interest. Privacy as such interpreted by the apex court in its various judgments means different things to different people. Privacy is a desire to be left alone, the desire to be paid for one's data and ability to act freely.

Telephone tapping and privacy

Right to privacy is affected by new technologies. Right to privacy relating to a person's correspondence has become a debating issue due to the technological developments. There have been cases of intercepting mails and telephonic communication of political opponents as well as of job seekers. Section 5(2) of the Indian Post Office Act and section 26(1) the Indian Telegraph Act empower the central and state governments to intercept telegraphic and postal communications on the occurrence of public emergency in the interest of public safety. *In R.M. Malkani* v. *State of Maharashtra,*[31] the Supreme Court observed that the court will not tolerate safeguards for the protection of the citizen to be imperilled by permitting the police to proceed by unlawful or irregular methods. Telephone tapping is an invasion of right to privacy and freedom of speech and expression and also government cannot impose prior restraint on publication of defamatory materials against its officials and if it does so, it would be violative of articles 21 and 19(1)(a) of the

[31] AIR 1973 SC 157.

Constitution. Kuldip Singh J opined in *People's Union for Civil Liberties* v. *Union of India*[32] that right to hold a telephonic conversation in the privacy of one's home or office without interference can certainly be claimed as right to privacy. In this case Supreme Court laid down certain procedural guidelines to conduct legal interceptions, and also provided for a high level review committee to investigate the relevance of such interceptions. But such caution has been thrown to winds in recent directives from government bodies as is evident from phone tapping incidents that have come to light. In *State of Maharashtra* v. *Bhrat Shanti Lai Shah*[33], the Supreme Court said that interception of conversation though constitutes an invasion of an individual's right to privacy it can be curtailed in accordance with procedure validly established by law. The court has to see that the procedure itself must be fair, just and reasonable and not arbitrary, fanciful or oppressive. An authority cannot be given an untrammeled power to infringe the right to privacy of any person.[34] In Neera Radia tape case[35] to use phone tapping as a method of investigation in a tax case seems to be an act of absurd overreaction. For so many journalists, politicians and industrialists to have their phone tapped without a rigorous process of oversight represents a gross violation of basic democratic principles.

Women's liberty and privacy

The right to privacy implies the right not merely to prevent the incorrect portrayal of private life but the right to prevent it being depicted at all. Even a woman of easy virtue is entitled to privacy and no one can invade her privacy as and when he likes.[36]The modesty and self respect may perhaps preclude the disclosure of such personal problems like whether her menstrual period is regular or painless *etc*.[37] The basic right of female is to be treated with decency and proper dignity. But if a person doesn't like marriage and lives with another it is entirely his or her choice which must be respected. Sense of dignity is a trait not belonging to society ladies only, but also to prostitutes.[38] Rape is not only a crime against

[32] . AIR 1997 SC 568.
[33] (2008) 13 SCC 5.
[34] *Directorate of Revenue* v. *Mohd. Nisar Holia* (2008) 1 SCC (Cri) 415
[35] *The Times of India*, Allahabad Times December 8, 2010.
[36] *State of Maharastra* v. *Madhuker Narayan Markikar*, AIR 1991 SC 207
[37] *Neera Mathur* v. *LIC of India*, AIR 1992 SC 392.

[38] *State of Punjab* v. *Baldev Singh*, AIR1999 SC 2378

the person of a woman it is crime against the entire society.[39] As a victim of sex crime she would not blame anyone but the culprit. Rapist not only violates the victim's privacy and personal integrity, but inevitably causes serious psychological as well as physical harm in the process. Rape is not merely assault- it is often destructive of the whole personality of the victim.[40] Right to privacy is an essential requisite of human personality embracing within it the high sense of morality, dignity, decency and value orientation.

The question of relation between the right to privacy and conjugal rights arose for the first time in *Sareetha* v. *Vankta Subbaih,*[41] wherein the Andhra Pradesh High Court held the provisions of section 9 of the Hindu Marriage Act 1955 *i.e.* the restitution of conjugal rights, as unconstitutional as it is violative of article 21 of the Constitution of India *vis-à-vis* right to privacy. But in *Harvinder Kaur* v. *Harmander Singh,*[42] the Delhi High Court held that though sexual relations constitute most important attribute of the concept of marriage but they do not constitute its whole content. Sexual intercourse is one of elements that goes to make up the marriage but it is not *summum bonum*. In *Saroj Rani* v. *Sudarshan Kumar Chandha,*[43] the Supreme Court agreed with Delhi High Court and thereby upheld the constitutionality of section 9. This right is within the right to marry and it does not violate the right to privacy of wife. It has been generally felt that the Supreme Court in this case lost an ideal opportunity for changing law in this regard in accordance with the changing spirit of the times. The right of the husband or the right of wife to the society of the other is not a creation of statute. The Law Commission of India in its 71st report stated that the essence of marriage is the sharing of common life, the sharing of all the happiness that life has to offer and all the miseries that have to be faced in life, an experience of the joy that comes from enjoying the common things of the matter. Once the woman enters into the marriage relation, her right to privacy must be seen in the context of family life.

The other question that may be raised regarding the appropriateness of giving legislative

[39] *Dinesh* v. *State of Rajasthan*, AIR 2006 SC 1267 & *State of Panjab* v. *Ramdev Singh*, AIR 2004 SC 1290.
[40] *Rajinder* v. *State of H.P.*, (2009) 16 SCC 69
[41] AIR 1983 AP 346.
[42] AIR1984 *Del* 66.
[43] AIR1984 SC 1562.

judgment about abortion. The objective in prohibiting abortion is to protect the societal interest in procreation. If women were given the ultimate right of privacy to terminate pregnancy whenever they wish to do so, such right if exercised by the women could effectively threaten the life of the unborn child and the societal interest in procreation. The question is whether the right to privacy encompasses woman's decision or not? A woman's right to make reproductive choices is also a dimension of personal liberty as understood under article 21 of the Constitution. Reproductive choices can be exercised to procreate as well as to abstain from procreating. The crucial consideration is that a woman's right to privacy, dignity and bodily integrity should be respected. Reproductive rights include a women's entitlement to carry pregnancy to its full term, to give birth and to subsequently raise children.[44] A woman's right to terminate her pregnancy is not absolute and may to some extent be limited by the state's legitimate interests in safeguarding the woman's protecting potential human life.

Recognizing that the sanctity of life has a supreme value in the hierarchy of values, it is nonetheless true that the human fetuses cannot claim any rights superior to that of born persons because of the following reasons:[45]

a. A fetus is not a person;

b. The court does not know 'when life begins', it does know that 'the unborn have never been recognized in the law as persons in the whole sense;

c. We do not agree that life begins at conception and is present throughout pregnancy.

Hence, many countries in the world have reformed their laws to allow abortion in a variety of circumstances, usually abnormality in the fetus, or the pregnancy being a result of rape or incest or danger to the life of the mother. In fact, an abortion decision involves competing interests of the society,that of the woman and also that of the foetus. Abortion should not be recognized as a matter of personal privacy and must be prohibited unless there is an urgent necessity.

Press, e-media and privacy

The freedom of press has not been expressly mentioned in article 19 of the Constitution of India but has been interpreted that it is implied under it. In *R. Rajagopal* v. *State of*

[44] *Suchita Srivastava* v. *Chandigarh Admn.* , (2009) 9 SCC 1.
[45] *Roe* v. *Wade*, 410 U.S. 113 (1973); 35 L.Ed. 2d. 147

Tamilnadu[46], the Supreme Court held that the petitioners have a right to publish what they allege to be the life-story/autobiography of Auto Shankar insofar as it appears from the public records, even without his consent or authorization. But if they go beyond that and publish his life story, they may be invading his right to privacy. The Constitution exhaustively enumerates the permissible grounds of restriction on the freedom of expression in article 19 (2); it would be quite difficult for courts to add privacy as one more ground for imposing reasonable restriction. So, a female who is the victim of sexual assault, kidnapping, abduction or a like offence should not further be subject to the indignity of her name and the incident being published in press media.[47] The freedom of speech and expression as envisaged in article 19 (1)(a) of the Constitution also clothes a police officer to seize the infringing copies of the book, document or newspaper and to search places where they are reasonably suspected to be found, impinging upon the right to privacy.[48] Newspaper or a journalist or any body has the duty to assist the state in detection of the crime and bringing criminal to justice. Withholding such information cannot be traced to right to privacy in itself and is not an absolute right.[49] Regarding protection of privacy *vis-à-vis* encroachment by press the judicial approach is not very clear. There is no specific legislation in India which directly protects right to privacy against excessive publicity by press. E-media includes television, radio, internet broadcast, and all electronic journalism which are used by today's media. Main purpose of media is to bridge the gap between government policy and public grievances. In *Destruction of Public & Private Properties* v. *State of A.P*[50], the Supreme Court held that media should base upon the principles of impartiality and objectivity in reporting; ensuring neutrality; responsible reporting of sensitive issues, especially crime, violence, agitations and protests; sensitivity in reporting women and children and matters relating to national security; and respect for privacy. Casting couch is very popular tool used by media nowadays which directly hammers the individual privacy. There is no guideline to handle this issue.

Information privacy

Information privacy or data privacy is the relationship between collection and dissemination

[46] AIR 1995 SC 264
[47] *R. Rajagopal* v. *State of Tamilnadu,* AIR 1995 SC 264
[48] *State of Maharashtra* v. *Sangharaj Damodar Rupawate*, (2010) 7 SCC 398.
[49] *People's Union for Civil Liberties* (*PUCL*) v. *Union of India*, AIR. 2004 SC 456
[50] AIR 2009 SC 2266

of data technology, the public expectation of privacy, and the legal and political issues surrounding them. The extent to which confidentiality is to be protected could be understood from a few cases. In Union of India v. Association of Democratic Reforms,[51] the Supreme Court has put its stamp on the issue. The right to get information in a democracy is recognized all throughout and it is a natural right flowing from the concept of democracy. Article 21 confers on all persons a right to know which include a right to receive information. The ambit and scope of article 21 is much wider as compared to article 19(1) (a).[52] In People's Union for Civil Liberties (PUCL) v. Union of India[53], the Supreme Court observed that right to information of a voter or citizen is thereby promoted. When there is a competition between the right to privacy of an individual and the right to information of the citizens, the former right has to be subordinated to the latter right as it serves larger public interest. The question arises to what extent a voter has a right to know about a candidate's privacy. The voter's right to know about a candidates privacy can be protected and flourished by removing the drawbacks of laws relating to voters right to information. Privacy means the right to control the communication of personally identifiable information about any person. It requires a balancing attitude; a balancing interest. Thus it ultimately requires a healthy and congenial inter-relationship between the social good and the individual liberty. Thus, it is concluded that one has to maintain a balance between the right to information of a citizen and the right of privacy of a candidate seeking election.

Health and privacy

Health sector is the important concern in privacy. Your health information includes any information collected about your health or disability, and any information collected in relation to a health service you have received. Many people consider their health information to be highly sensitive. The right to life is so important that it supersedes right to privacy. Under medical ethics, a doctor is required not to disclose the secret information about the patient as the disclosure will adversely affect or put in danger the

[51] AIR 2002 SC 2112
[52] *Reliance Petrochemicals Ltd*. v. *Proprietors of Indian Express Newspapers*, AIR 1989 SC 190.
[53] AIR 2003 SC 2363.

life of other people.[54] In *Mr. 'X'* v. *Hospital 'Z'*[55] the Supreme Court held that the doctor patient relationship though basically commercial, is professionally a matter of confidence and therefore, doctors are morally and ethically bound to maintain confidentiality. In such a situation public disclosure of even true private facts may sometimes lead to the clash of one person's right to be let alone with another person's right to be informed. In another case the apex court said that[56] the hospital or doctor was open to reveal such information to persons related to the girl whom he intended to marry and she had a right to know about the HIV-positive status of the appellant. The court also held that the appellant's right was not affected in any manner in revealing his HIV-positive status to the relatives of his fiancée.

In *Selvi* v. *State of Karnataka* the Supreme Court held that narco-analysis, lie-detection and BEAP tests in an involuntary manner violate prescribed boundaries of privacy. A medical examination cannot justify the dilution of constitutional rights such as right to privacy. If DNA test is eminently needed to reach the truth, the court must exercise the dissector of medical examination of a person. Therefore, the Supreme Court was of the view that though the right to personal liberty has been read into article 21, it cannot be treated as an absolute right. To enable the court to arrive at a just conclusion a person could be subjected to test even though it would invade his right to privacy. It concluded that one has to maintain a balance between the rights of a citizen and the right to privacy. It ultimately requires a healthy and congenial enter- relationship between the social good and the individual liberty.

III Privacy and data protection

Privacy and data protection require that information about individuals should not be automatically made available to other individuals and organizations. Each person must be able to exercise a substantial degree of control over that data and its use. Data protection is legal safeguard to prevent misuse of information about individual person on a medium including computers. It is adoption of administrative, technical, or physical deterrents to safeguard personal data. Privacy is closely connected to data protection. An individual's

[54] *Spring Meadows Hospital* v. *Hajot Ahluwalia* ,AIR 1998 SC 1801
[55] AIR 1999 SC 495
[56] *Mr. 'X'* v. *Hospital 'Z'*, AIR 2003 SC 664

data like his name address, telephone-numbers, profession, family, choices, *etc*. are often available at various places like schools, colleges, banks, directories, surveys and on various web sites. Passing of such information to interested parties can lead to intrusion in privacy like incessant marketing calls. The main principles on privacy and data protection enumerated under the Information Technology (Amendment) Act, 2008 are defining data, civil and criminal liability in case of breach of data protection and violation of confidentiality and privacy.

Concept of data protection

The Information Technology Act which came into force in the year 2000 is the only Act to date which covers the key issues of data protection, albeit not every matter. In fact, the Information Technology (Amendment) Act, 2008 enacted by the Indian Parliament is the first legislation, which contains provisions on data protection. According to section 2(1)(o) of the Act, "Data" means a representation of information, knowledge, facts, concepts or instructions which are being prepared or have been prepared in a formalised manner, and is intended to be processed or is being processed or has been processed in a computer system or computer network, and may be in any form (including computer printouts magnetic or optical storage media, punched cards, punched tapes) or stored internally in the memory of the computer". The IT Act doesn't provide for any definition of personal data and, the definition of "data" would be more relevant in the field of cyber-crime. Further, the IT Act defines certain key terms with respect to data protection, like access, [57] Computer, Computer network, Computer resource, Computer system, Computer database, Data, Electronic form, Electronic record, Information, Intermediary, Secure system,and Security procedure. The idea behind the aforesaid section is that the person who has secured access to any such information shall not take unfair advantage of it by disclosing it to the third party without obtaining the consent of the concerned party. 'Third party information' is defined to mean 'any information dealt with by an intermediary in his capacity as an intermediary', and it may be arguable that this limitation also applies to 'data' and 'communication'. Section 79 provides that an intermediary shall not be liable for any third party information, data, or communication

[57] Information (Amendment) Technology Act , 2008, s. 2 (1) (a).

link made available or hasted by him except in the conditions provided in sub-section (2) and (3) thereof.

The IT Act doesn't provide any definition of personal data. Furthermore, the definition of "data" would be more relevant in the field of cyber-crime. Data protection consists of a technical framework of security measures designed to guarantee that data are handled in such a manner as to ensure that they are safe from unforeseen, unintended, unwanted or malevolent use.

Civil liability and data protection

The Information Technology (Amendment) Act 2008 provides for civil liability in case of computer database theft, computer trespass, unauthorized digital copying, downloading and extraction of data, privacy violation *etc*. Furthermore, section 43 provides for penalty for a wide range of cyber contraventions such as: (a) related to unauthorised access to computer, computer system, computer network or resources; (b) unauthorised digital copying, downloading and extraction of data, computer database or information, theft of data held or stored in any media; (c) introduced any computer contaminant or computer virus into any computer system or computer network; (d) unauthorised transmission of data or programme residing within a computer, computer system or computer network; (e) computer data/database disruption, spamming *etc.*; (f) denial of service attacks, data theft, fraud, forgery *etc.*; (g) unauthorised access to computer data/computer databases; (h) instances of data theft (passwords, login IDs) *etc.*; (i) destroys, deletes or alters any information residing in a computer resource *etc* and (j) steal, conceal, destroy or alter any computer source code used for a computer resource with an intention to cause damage. Explanation (ii) of section 43 provisions definition of computer database as "a representation of information, knowledge, facts, concepts or instructions in text, image, audio, video that are being prepared or have been prepared in a formalized manner or have been produced by a computer, computer system or computer network and are intended for use in a computer, computer system or computer network."

Section 43A provides for 'compensation for failure to protect data', it provides: "Where a body corporate, possessing, dealing or handling any sensitive personal data or information in a computer resource which it owns, controls or operates, is negligent in implementing and maintaining reasonable security practices and procedures and thereby causes wrongful loss

or wrongful gain to any person, such body corporate shall be liable to pay damages by way of compensation to the person so affected". There is no limitation imposed on the compensation that can be awarded. Section 43A which provides for civil action for security breaches is based on the concept of 'sensitive personal information'. Other than that, there is no special protection in Indian law for sensitive personal information. Section 43A provides for compensation to an aggrieved person whose personal data including sensitive personal data may be compromised by a company, during the time it was under processing with the company, for failure to protect such data whether because of negligence in implementing or maintaining reasonable security practices.

This provision, therefore, provides a right of compensation against anyone other than the person in charge of the computer facilities concerned, effectively giving a person a right not to have their personal information disclosed to third parties, or damaged or changed by those third parties. The section is equally able to be used by data controllers or the subjects of personal information against third parties. It is only that they will be 'affected' in different ways which justify compensation. It also provides that accessing data in an unauthorized way is a civil liability.

Criminal liability and data protection

The Information Technology (Amendment) Act, 2008 provides for criminal liability in case of computer database theft, privacy violation etc. The Act also make wide ranging amendments in chapter XI enfacing sections 65-74 which cover a wide range of cyber offences, including offences related to unauthorised tempering with computer source documents, dishonestly or fraudulently doing any act referred to in section 43, sending offensive messages through communication service *etc*., dishonestly receiving stolen computer resource or communication device, identity theft, cheating by personation by using computer resource, violation of privacy, cyber terrorism, transmitting obscene material in electronic form, transmitting of material containing sexually explicit act, etc., in electronic form, transmitting of material depicting children in sexually explicit act, *etc*., in electronic form, any intermediary intentionally or knowingly contravening the provisions of sub-section (1) of section 43, any person intentionally or knowingly failing to comply with any order of controller, interception or monitoring or decryption of any information through any computer resource, blocking for public access of any

information through any computer resource, intermediary contravening the provisions of sub section (2) of section 69B by refusing to provide technical assistance to the agency authorised by the Central Government to monitor and collect traffic data or information through any computer for cyber security, securing access or attempting to secure access to any computer resource which directly or indirectly affects the facility of Critical Information Infrastructure, any misrepresentation to or suppressing any material fact from the Controller or the Certifying Authority, breach of confidentiality and privacy, disclosure of information in breach of lawful contract, publishing electronic signature certificate false in certain particulars, and electronic signature certificate for any fraudulent or unlawful purpose.

India does not have specific data protection legislation, other then the IT Act, which may give the authorities sweeping power to monitor and collect traffic data, and possibly other data. The IT Act does not impose data quality obligations in relation to personal information and does not impose obligations on private sector organizations to disclose details of the practices in handling

personal information.

Violation of confidentiality and privacy

The terms violation of confidentiality and privacy are described under the IT Act. Section 66-E very eloquently explains violation of privacy as 'whoever, intentionally or knowingly captures, publishes or transmits the image of a private area of any person without his or her consent, under circumstances violating the privacy of that person.' Section 66-E explanation (e) has also explained violation of privacy as 'circumstances in which a person can have a reasonable expectation that—(i) he or she could disrobe in privacy, without being concerned that an image of his private area was being captured; or (ii) any part of his or her private area would not be visible to the public, regardless of whether that person is in a public or private place.' Section 72 provides for penalty for breach of confidentiality and privacy as meaning 'any person securing access to any electronic record, book, register, correspondence, information, document or other material without the consent of the person concerned discloses such electronic record book, register, correspondence, information, document or other material to any other person.' Section 72A also explains the law of privacy and asserts that disclosure of information in breach of lawful contract –'save as

otherwise provided in this Act or any other law for the time being in force, any person including an intermediary who, while providing services under the terms of lawful contract, has secured access to any material containing personal information about another person, with the intent to cause or knowing that he is likely to cause wrongful loss or wrongful gain discloses, without the consent of the person concerned, or in breach of a lawful contract, such material to any other person' amounts to breach of privacy and provides for punishment for the same.

Sections 66E, 72, and 72A require the consent of the concerned persons but, within limited scope as it would be difficult to consider that it could provide a sufficient level of personal data protection. Indeed, these sections confine themselves to the acts and omissions of those persons, who have been conferred powers under the Act. These sections provide for monitoring violation of privacy, breach of confidentiality and privacy, and disclosure of information in breach of lawful contract. Breach of confidentiality and privacy is aimed at public and private authorities, which have been granted power under the Act. *In District Registrar and Collector* v. *Canara Bank,*[58] the Supreme Court said that the disclosure of the contents of the private documents of its customers or copies of such private documents, by the bank would amount to a breach of confidentiality and would, therefore, be violative of privacy rights of its customers.

IV Conclusion

Privacy is a basic human right and computer systems contain large amounts of data that may be sensitive. Chapters IX and XI of the Information Technology Act define liabilities for violation of data confidentiality and privacy related to unauthorized access to computer, computer system, computer network or resources, unauthorized alteration, deletion, addition, modification, destruction, duplication or transmission of data, computer database, *etc*. The data protection may include financial details, health information, business proposals, intellectual property and sensitive data.

However, today one can access any information related to anyone from anywhere at any time but this poses a new threat to private and confidential information. Globalization has given acceptance to technology in the whole world. As per growing requirement different

[58] AIR 2005 SC 186

countries have introduced different legal framework like DPA (Data Protection Act) 1998 UK, ECPA (Electronic Communications Privacy Act of 1986) USA etc. from time to time. In the USA some special privacy laws exist for protecting student education records, children's online privacy, individual's medical records and private financial information. In both countries self-regulatory efforts are facilitating to define improved privacy surroundings.

The right to privacy is recognized in the Constitution but its growth and development is entirely left to the mercy of the judiciary. In today's connected world it is very difficult to prevent information to escape into the pubic domain if someone is determined to put it out without using extremely repressive methods. Data protection and privacy has been dealt within the Information Technology (Amendment) Act, 2008 but not in an exhaustive manner. The IT Act needs to establish setting of specific standards relating to the methods and purpose of assimilation of right to privacy and personal data. To conclude it would suffice by saying that the IT Act is facing the problem of protection of data and a separate legislation is much needed for data protection striking an effective balance between personal liberties and privacy.

TOPIC NO. 4

USE OF SCIENCE AND TECHNOLOGY IN JUDICIAL INVESTIGATIONS

FORENSIC SCIENCE

Forensic science is defined as the application of science in answering questions that are of legal interest. More specifically, forensic scientists employ techniques and tools to interpret crime scene evidence, and use that information in investigations. Forensic scientists and technicians come from a variety of academic backgrounds, although most have completed coursework in the life sciences, chemistry and law enforcement.

Types of Evidence:

Forensic scientists often work as generalists, meaning that they have expertise in working with a wide variety of evidence types. However, many also specialize in the use of certain techniques and tools. Different types of evidence require different skills and equipment. Types of evidence that are most frequently analyzed during investigations include: trace evidence and biological and ballistic evidence. Trace evidence is found wherever an object or person has had contact with another object or person and each of the objects leaves behind some sign of its having been there. Fingerprints and tire tracks are examples of trace evidence. Biological evidence will be found wherever there is bodily fluid or human or animal remains, and can include DNA testing. Ballistics is the study of firearms and, in particular, the path that a bullet takes during flight.

i) Biological Evidence:

In examining biological evidence, forensic scientists use tools both at the scene, and in the lab. When a forensic scientist arrives at a crime scene, he may look for human remains, blood or other bodily fluids and collect samples of any that are found. Because not all bodily fluids (particularly those that have been cleaned up after) are visible to the naked eye, the scientist can use the chemical Luminol to show latent traces of blood. Where large quantities of blood are present, an expert in blood spatter analysis can examine the patterns and size of the bloody areas to determine information such as the trajectory of the blood. This data can help an investigator deduce what type of weapon was used, or where the perpetrator and victim were standing during the attack.

ii) DNA Evidence:

DNA evidence uses the unique genetic markers that identify individuals to determine whether a person was at a scene, or to identify a piece of property as belonging to a specific person. In order to identify an individual's DNA it must be extracted from a piece of property that a person has had contact with, and has left a bodily fluid such as semen, blood or saliva on. The scientist performs tests that identify genetic markers and create a profile that is unique to that person, and can be compared to a sample taken from any individual. Scientists may also attempt to get enough blood from evidence to conduct toxicology testing, to determine the presence of alcohol, drugs, poisons or chemicals.

iii) Trace Evidence:

Trace evidence is found where two objects have made contact with each other. When a person or an object touches another object, some 'trace' of the two will be exchanged. This is the theory behind the analysis of fingerprints, tire and footprints, and fiber analysis. Technicians lift fingerprints from surfaces by dusting the area with a powder which sticks to the oils in the fingerprint. She then employs fingerprint lifting tape to take the print from the surface to the lab, where it can be analyzed. In the case of a footprint, tire track or other pattern that was left in an outdoor area, a forensic scientist can fill in the depression with plaster, which can be removed after it sets up. The casting is taken to a lab where it is stored until needed, or compared against a

known sample, such as a suspect's shoe.

iv) Ballistics:

Some forensic scientists specialize in the field of ballistics testing. Ballistics is a science that involves the science of the flight path that a bullet takes as it travels to its target. Trained ballistics specialists can glean a tremendous amount of information about the type of weapon that was used, the path of the bullet and more through the examination of the bullet itself. Guns produce a specific pattern of wear and grooves on bullets as they are fired, and this pattern is unique. By examining the bullets and test-firing weapons, an investigator can frequently either identify the type of firearm that was used, where it was fired from, or even match the bullet with a specific weapon.

Scope of Forensic Science:

Forensic science has shaped the world of justice, fuelling crime investigations and signifying the progress of modern technology. Forensic science of today covers :

· Modern computer/clay facial reconstruction;

· DNA fingerprinting;

· Autopsy techniques;

· Forensic anthropology;

· Toxicology and much more.

What more reliable method is there to prove innocent or guilty other than through science?

Forensic Psychology:

Psychological evaluation is regarded as the key to human brain in crime investigation.

There are certain steps to be followed in psychological evaluation, which includes:

i) Psychological profiling

ii) Psychological assessment

iii) Polygraph

iv) Brain Electrical Oscillation Signature Profile (BEOS)

v) Narcoanalysis

Psychological Profiling:

Psychological Profiling is the study of the psychological background of the person. This is done for the complete understanding of the individual. It consists of the following:

a) Personal History: Family, childhood behaviour, education, occupation, health, sex marriage, emotional and fantasy life, habits, moral life alcohol or substance use, religious and other cultural ballets, interpersonal and social relationships.

b) Mental Status Examination: Presence of psychiatric and neurological symptoms, abnormality in orientation, attention, concentration, memory, speech, perception, mood, thought processes, judgement, incite and other behavioural manipulations are assessed.

Psychological Assessment:

This assessment helps us to understand the personality, attitudes, beliefs, moral values, behavioural patterns of the individuals and specially their tendency to commit crimes.

Assessment also aims at cheching for the presence or absence of various forms of abnormal behaviour and personality disorders that can lead to criminal behaviour.

It also reveals a person's tendencies to lie, fake, manipulate, put himself in good or bad light etc. especially in a standard social situation.

Polygraph:

It measures physiological responses produced by inducing stress by asking questions.

This is done by:

· Verifying the veracity of statements of suspect, witness and complainant in crimes.

· Economize the process of investigation by creening large number of suspects.

· Corroborates or rules out the possibility of someone's involvement and helps investigation.

· Variety of testing formats available based on the nature of case and information available.

Brain Electrical Oscillation Signature Profile (BEOS):

This was developed by Dr. Mukundan based on the concept of Experiential Knowledge (EK). EK is the memory acquired when an individual participates and is fully involved in an event (Crime) which becomes an experience.

Probes related to the crime activates memory (EK) related to the experience of committing the crime causing significant electrical changes in the brain.

Scope of BEOS:

· Checks for the individuals involvement in a crime.

· Differentiates the extent of participation of each individual in the crime.

· Various possibilities about the way the crime was committed can be tested.

· Acquires information directly from the brain and does not require the person's participation leaving no scope for manipulation.

Narcoanalysis:

It is an invasive technique in which sodium pentothal, a drug is injected to the subject to induce a semiconscious state and disinhibition and he is interviewed on the details of the crime.

Sodium Pentothal removes conscious control and makes the person disinhibited. It makes him more relaxed, comfortable, open, free and conversant.

Narcoanalysis is conducted at an operation theatre with the necessary facilities for life support wherein the psychologist injects the drug and retrieves vital physiological parameters and forensic psychologist conducts the interview.

Scope of Narcoanalysis:

· Scientific technique but can help elicit concealed information related to the crime.

· Helpful especially in cases of larger social interest like terrorism

· Results admissible in the court can help further investigation in a case.

· Court order is mandatory for Narco analysis.

Cyber Forensics:

It is the art and science of applying computer science to aid the legal process. Although plenty of science is attributable to computer forensics, most successful investigators possess a nose for investigations and a skill for solving puzzles, which is where the art comes in. - Chris L.T. Brown, Computer Evidence Collection and Preservation, 2006.

Thus, it is more than the technological, systematic inspection of the computer system and its contents for evidence or supportive evidence of a civil wrong or a criminal act. Computer forensics requires specialized expertise and tools that goes above and beyond the normal data collection and preservation techniques available to end-users or system support personnel. One definition is analogous to "Electronic Evidentiary Recovery, known also as e-discovery, requires the proper tools and knowledge to meet the Court's criteria, whereas Computer Forensics is simply the application of computer investigation and analysis techniques in the interests of determining potential legal evidence."[1] Another is "a process to answer questions about digital states and events". This process often involves the investigation and examination computer system(s), including, but not limitied to the data acquisition that resides on the media within the computer. The forensic examiner renders an opinion, based upon the examination of the material that has been recovered. After rendering an opinion and report, to determine whether they are or have been used for criminal, civil or unauthorized activities. Mostly, computer forensics experts investigate data storage devices, these include but are not limited to hard drives, portable data devices (USB Drives, External drives, Micro Drives and many more).

Scope of Cyber Forensics:

Cyber experts provides various Forensic Science services including- Forensic Expert Opinions Under Section 45 of Indian Evidence Act on Questioned Document & Handwriting Analysis, Fingerprints, Forged Electronic Documents, Digital Document Frauds, Disguised Documents, Spoofed Emails, Phishing emails, Phishing sites, Copyrighted Websites, Original Author, Real Creator, Designer or Owner of Computer Files, eContracts, eAgreements,

Authenticity of Images, Photo, Camera, Video, Audio Files, Film, Tape, Picture, Deleted Data Recovery, Digital Evidence Recovery, Location of Email, IP Location, Website Registrar, Fake Content, Fake Profiles, Porn Clips, Vulgar Emails, Spam Mails, Lottery Emails, Secure Deletion of Sensitive Information, Retrieving user history, password recovery, login details recovery, MMS, Sim Card Data Recovery, Call History on Mobile Phone, Deleted SMS Recovery, Electronic Evidences Collection, Mirror Imaging, Hash Value, Scanned Documents, Duplicate Documents, Decipher, Invisible Writing, Hidden Evidences, Blackmailing Messages, Suicide Notes, Disputed Documents, Legal Softwares, Forensic Work Stations, EnCase, Forensic Tool Kit, iLook, Xway, Cyber watch, Guidance, Access Databases, Outlook Express Email Recovery, Web Mail Traces, PDF Files, Excel Files, Litigation, Threatening or Anonymous Emails / Chat, File or Folder Age / Date / Time Analysis, Cross Examination, Expert Testimony, Typewritten Document Examination, Computer Printout Examination, Infrared / Ultra Violet Examination of Printed Papers, fake agreements, Consumer Court related documents, Expert Consultation, Breach of Confidentiality, Legal Consultancy, Wrongful Termination, Forensic Imaging, Forensic Photography, and many more...

Common types of Cyber Crime in India:

- Financial Crimes
- Cyber Pornography
- Sale od illegal article
- Online gambling
- Intellectual Property Crimes
- Email Spoofing
- Forgery
- Cyber Defamation
- Cyber stalking

Digital Evidence Recovery:

This includes:

· Searching slack space

· Searching unallocated clusters

· Reconstructing the partitions if needed

· Extracting deleted files

· Reading operating system registry and logs

· Extracting emails, web addresses, internet history, credit card numbers etc.

· Recovering the passwords set to the files

· Reading contents in printer spool files

· Reading mobile phone memory

· Reading contents of sim cards

· Reading contents of additional memory cards

· Extracting existing and deleted call logs, messages, address book, images etc.

Steps involved in Cyber forensics:

· Identification: identify the media to be seized

· Seizure: use the right technique to seize the media

· Acquisition: making a forensic duplicate of the media

· Authentication: validation of forensic duplicate

· Analysis: techniques to look for evidence

· Presentation: putting together all the findings

· Preservation: storage of the suspect media

Explanation:

Speaker Identification:

It is the way of identifying a person solely by their speech. The aim of speaker identification is to compare the sample from the unknown speaker with the known set of samples and determine whether it was produced by any of the known speakers.

Importance of Speaker Identification Technique in Crime Investigation:

It plays a major role in solving the following types of cases:

· Bribery cases

· Kidnapping for ransom

· Call girl rackets

· Obscene telephone calls
· Bomb threat calls
· Terrorist to claim credit for a terrorist action
· False telephonic message
· False fire alarms

Tape Authentication:

To determine whether or not a tape has been edited, tampered with, or altered in any way. Video authentication is a process that is used to ascertain the trustworthiness of a digital video.

In other words, a video authentication system ensures the integrity of digital video, and verifies that the video taken into use has not been tampered.

Toxicology:

It is a science embodying the knowledge, source, character, fatal effect, lethal dose, analysis of poisons and the remedial measures.

Poison:

It is a substance which is capable of producing injury or death to living beings, when ingested or absorbed.

Eg: LD 50 (Lethal Dose): It is a dose of a substance causing death of 50% animals.

Extremely toxic substance weighs less than 5mg

Toxicology can pull the following sections:

· Section 174 of Cr.P.C: Poison Consumption
· Section 302 of IPC: Murder
· Section 279 of IPC and Motor Vehicle Act: Accidents
· Section 309 of IPC: Suicide
· Section 498(A) of IPC: Dowry Death

TLC: (Thin Layer Chromatography):

This is a simple and sensitive technique routinely used in forensic science laboratories. In this technique glass plates of size 20x20 cm are coated with slurry of silica gel G. dried in oven at 110 oC. Extracts of the matrices are spotted on these plates. Then plates are eluted in the developing chamber containing solvent mixtures hexane: Acetone 8:8 v/v as a mobile phase. When solvent reaches upto 10cm height, plates are removed, dried and sprayed with different visualizing reagents. In TLC Rf – value is an important measure.

All pesticides, insecticdes, plant growth regulators, weedicides, herbicides, fungicides and most of the drugs can be detected using this technique.

Visualization reagents for insecticides:

Organophosphorous: Rogor, Thimet: Mercurous nitrate, Mercuric nitrate-DPC

Organochlorine: Endosulfan: NaOH followed by Nickel Amine

Carbamate insecticides: Bagon: Tollen's reagent, Diazophenol reagent

Pyrethroids: NaOH followed by $FeSO_4$ followed by HCl, Resorcinon in NaOH

For Phenois, Cresois: Iodine vapours, $FeCl_3$ followed by $K_4Fe(CN)_6$

Drugs, Plant Poisons: Dragandorff's reagent, acidic $KMnO_4$, Chromic acid

Steps to be followed in investigation of death by Poison Consumption:

· Crime Scene Observation
· Hospitalisation to victim
· Collection of stomach aspirates by M.O.
· Collection of poison bottles, drug strip
· Suspicious articles
· Stained clothes

Collection of Viscera in post mortem be CMO:

· Stomach intestine contents,

· Heart, Liver, spleen, lungs, kidneys

· Blood

· Preservatives

Tools that are used in Forensic Examination & Investigation:

Forensic examination and investigation is a field of science that is employed every day to help bring criminals to justice. Television shows, such as "CSI: Crime Scene Investigation," have popularized the field. But in real life, forensic examination involves long hours of careful observation, testing and study. A number of special tools and techniques have been developed to help investigators do their job.

Blood Testing

While not as accurate as genetic fingerprinting, testing for a blood type is still a useful tool for helping to determine guilt or innocence. If a victim has type A blood and a drop on a suspect's shirt turns out to be type B, it cannot have come from the victim.

Comparison microscopes

These specialized microscopes allow forensic scientists to compare two bullets at the same time. An evidence bullet is compared to one fired from a suspect's gun under controlled circumstances. The comparison lets scientists tell if the evidence bullet was also fired from the suspect's gun.

Neutron Activation Analysis

This process allows forensic scientists to compare shards of a shattered bullet on an atomic level. The shards can then be compared with the metallic makeup of bullets found in a suspect's possession.

Autopsies

Autopsies are used to determine the time and cause of death. For example, if a person has drowned, the blood on the left side of the heart will be diluted with water. If a body has been found in a pool with undiluted blood, forensic scientists know that the person was not breathing when they went into the water and was possibly killed first.

Electron Microscopes

Electron microscopes can magnify surfaces as much as 200,000 times.

Chemical analyzers

Mass spectrometers and gas cinematographers are used to analyze and separate chemical components, which is particularly useful in drug-related crimes.

Conclusion:

Forensic science plays an integral role in the criminal justice system. Well-trained forensic scientists and medical examiners can be the determining factor in the ability of evidence to adequately represent the facts of a case. Forensic science can be used in almost any criminal case; however, investigations of homicide, rape, and arson are those that benefit the most from forensic science.

Everyone is familiar with the television show “C.S.I.” While this show involves a lot of idealism, and often times skews the reality of forensic science, at its core “C.S.I.” represents the importance that quality forensic science can play in a complicated case. In complicated cases, and even in relatively simple ones, the most minute of details can become paramount to a successful prosecution or defense. Forensic scientists are trained to analyze crime scenes, evidence, and personal testimony to create a visualization of how a crime occurred. An understanding of the circumstances surrounding a crime is pivotal to ensuring that the correct charges are brought against the correct person. The mishandling or misinterpretation of evidence can be devastating to the goals of the criminal justice system and can result in the wrongful conviction of innocent persons and the failure to convict the true perpetrator, which is why you need a skilled criminal defense lawyer in Knoxville if you’ve been convicted of a criminal offense. Conversely, correctly applied forensic science ensures that justice is served and innocent persons remain free.

Topic No. 5

BIOTECHNOLOGY & LAW

Introduction

Throughout the history man has gained closer insight in to the natural things and continually striving to control the environment and the things which are having life to use them for his own needs. Different methods involving biological activities used anciently as traditionally. Cultivation of plants seems as biotechnological application, agriculture which was human derived used biotechnology to make the products. Agriculture has become the dominant system to produce food since Neolithic age by the early biotechnology. As we had many different types of crops to cultivate has increased to maintain. Early farmers discovered that specific organisms and their by-products having highest yields will produce more food for growing population. In the course of history of agriculture, farmers changed the genetics of their crops breed them with other plants in different environmental conditions-which was one of the forms of biotechnology. In the modern age, people started baking cake and making wine with grapes at professional level. At the time of medieval association of merchants called guilds ruled over trading, many changes have occurred in technology and trade. In 17th century guilds system of trade got reduced due to changes in technology. Finally, industrial enterprises and large-scale production introduced.

After the discovery of Leeuwenhoek's microscope microorganisms could be seen, in 1865 only after 200 years, Pasteur has given scientific description for fermentation process. At that time another achievement was done, at a session of the Hungarian Society of Natural Sciences on 13th November, 1861, a Hungarian chemist, M. Preysz, reported on a procedure for

the preservation of wine by heat treatment. His method was published, however, only in 1865, after Pasteur's famous publication, the discovery has not given legal priority. It is generally not known that the term "biotechnology" was first used by a Hungarian expert, K. Ereky, in his book published in 1919: "The Biotechnology of Meat, Fat, and Milk Production in the Agricultural Plant". Since ancient times Hungarians were interested in life related problems to resolve them. Humankind was interested in biology since the close relationship with nature and adopted the attitude of observing the field of science. The American Chemical Society defines biotechnology as the application of biological organisms, systems, or processes by various industries to learn about the science of life and the improvement of the value of materials and organisms such as pharmaceuticals, crops, and livestock . As per European Federation of Biotechnology, biotechnology is the integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services.

Basically biotechnology classified in to four major categories including crop production and agriculture, health care (medical), Environmental and industrial biotechnologies. A series of terms have coined for the identification of branches in biotechnology. For example:

- **Green biotechnology:** It is the technology applied to agricultural processes.
- **Red biotechnology:** It is the technology used in medical applications.
- **Blue biotechnology:** Blue biotechnology is the term used to describe aquatic and marine applications of biotechnology.
- **White biotechnology:** It is the technology used to industrial processes. All these derived technologies of biotechnologyare come out and named as modern biotechnology. It is updated term for traditional biotechnology. Modernbiotechnology is a term adopted by international convention to refer to biotechnological techniques for the manipulationof genetic material and the fusion of cells beyond normal breeding barriers and it also refers to the intentionalmodification and manipulations living organisms and organic matter .

The main techniques that gave birth to modern biotechnology are:

- **Genetic engineering:** This technique involves the change of nature of genetic matter of a living organism and tointroduce in to host organism to alter the nature of host organism.
- **Biochemical engineering:** This technique involves the maintenance of sterile conditions of a desired microorganism inbiotechnological processes to get the products like enzymes, hormones,

antibiotics, vaccines and medicines. World hasupdated with new applications of biotechnology from traditional to modern biotechnology. All over the world somecountry has their history of maintaining biotechnological applications with updated Modern Biotechnology techniques.

Development of Biotechnology in Various Countries

Traditional background of modern biotechnology in Japan

Special contributions in bioindustry and applied microbiology in Japan can be considered as development of modern biotechnology in Japan. This review tries to summarize those original contributions in industrial sector with living organisms. In the first part we can see bioindustry and applied microbiology. In the second part recent progresses achieved in Biotechnology, secondary metabolites, genetic engineering, and screening of microbial diversity. There was a long tradition in fermentation technology to produce variety fermented food stuffs in Japan. Sake brewing process is the best one in which saccharification of rice starch by amylases from a fungus Aspergillus oryzae . In the year 1894 the first industrial application of microbial ezymes was done by Japan scientist Jokichi Takamine in USA.

Development of modern biotechnology in India

In the year 1986, the Department of Biotechnology was established by the Ministry of Science and Technology for the development of biotechnology in India. It has become the new energy. The DBT has developed many centres in the country. Those centres are responsible for the making of new skilled persons in field of Biotechnology and to enlarge R&D in the private sector. The Indian government has sponsored to research areas like genetic engineering, molecular biology, agriculturaland medical sciences, plant and animal tissue culture, biofertilizers and biopesticides, environment, human genetics, microbial technology, and bioprocess engineering.

A good frame work was set up by the Indian government for Genetically Modified Crops and Recombinant DNA products for human health . The Indian Government introduced new policies. In 2005 patent system has come in to force to convey the world that Indian industry supports the framework of new initiatives. Many states in India started new policies to develop the biotechnology industry as a whole.

Development of modern biotechnology in Austria

In the progress of biotechnology Austria has contributed a lot in the past. In 1846 from the manufacturing of Vienna process of baker's yeast it has raised to achieve many developments in 20th century . For example, penicillin V, immune biotechnology, submerged vinegar process, biopulping, biocatalysis, mammalian cell technology, nanotechnology, biopolymers, and environmental biotechnology.

Evaluation of biotechnology in Hungary

First attempts in biotechnological production were done in consumer goods and food production. By using microbiology in pharmaceutical sector large production of vaccines were done in 1912. In the World War II from plant and animal origin medicinal products were made by the Hungarian pharmacist J. Kabay (1896-1936). After World War II development of fermentation technology was attained in Hungary itself. Vitamin B12 production first introduced in Hungary . Hungarians were the first in the world to introduce beer brewing by the application of bacterial enzymes.

Biotechnology in Switzerland and Germany

If we go back to the fermentation processes of the roots of biotechnology starting from spontaneous reactions were made by simple means. By discovery of antibiotics bioprocess engineering has become compulsory. It further developed as well established technological application. In automation using of computers enhance the quality of bioprocesses . Molecular biology, agriculture, genetic engineering applications got new developments in industrial sectors on both sides of Atlantic region. New advanced technology in Switzerland and Germany were established with the foundation of the European Federation of Biotechnology (EFB). In 1960s and 1970s a promised phase has given a way to a restrictive policy of insecurity demonstrates many European countries to new sciences like bioinformatics, genomics and proteomics .

Various Developmental Applications of Modern Biotechnology

To meet the needs of human beings', biotechnological applications were developed through various stages. Its development was based on observations and applications of observations. The main complication of biotechnology was increased due to upgradation of new technologies with in time. If we study the biotechnological developmental applications up to present age, we can divide them in three categories . Ancient biotechnology applications, classical biotechnology applications and Modern biotechnology applications. In this review we will discuss more on modern biotechnological applications .

Second World War became as big hindrance to stop many scientific discoveries. At the end of the second world war many scientific discoveries were reported which leads to modern biotechnology. Proposed structure of double helix of DNA by Watson and Crick was reported in the year 1953, after that Jacob and Monad has given the concept of operon in the year 1961 and Kohler and Milestein in 1975 introduced cytoplasmic hybridization to produce monoclonal antibodies for the first time which ultimately leads to diagnostic revolution. These types of basic revolutionized discoveries became as basic applications for multiple modern biotechnological applications in many fields like medical, Healthcare, agricultural, plant, environmental, industrial, microbial, regenerative medicine, pharmaceutical and biosecurity .

Biotechnology in Healthcare

Healthcare biotechnology refers to a vaccine or diagnostic or medicinal that consists of or has been produced by living organisms through recombinant DNA technology . This biotechnological application has major impact on patients to meet their needs. This application not only encompasses diagnostics and medicines by biotechnological process and also helps in gene, tissue and cell therapies.

Plant Biotechnology

Plant biotechnology is the technique which is used to manipulate the plants for specific needs or requirement. In basic agricultural practices we generally wait for natural production of offspring that will have basic quality. But in plant biotechnology we select the desired quality of a trait to clump with other quality to produce multiple qualitative traits in one offspring. For that plant biotechnology applies genetics, tissue culture, genetic engineering and transgenic crops. Plant tissue culture is a part of plant biotechnology which is the collection of many techniques that is used to maintain and grow plant, plant cells, plant tissues under controlled sterile conditions over the nutrient medium.

Marine Biotechnology

Marine Biotechnology is one of the new field of study, emerged in the past few years. It began in 1998 when scientists from the Scripps Institution of Oceanography and various departments of the University of California, San Diego, came together and formed the Centre for Marine Biotechnology and Biomedicine. The intention of Marine Biotechnology is to host scientific contributions in marine science that are based on the enormous biodiversity of marine

ecosystems and the genetic uniqueness of marine organisms to develop useful products and applications.

Environmental Biotechnology

Environmental biotechnology is biotechnology that is applied to and used to study the natural environment. Environmental biotechnology could also imply that one tries to harness biological process for commercial uses and exploitation . The International Society for Environmental Biotechnology defines environmental biotechnology as "the development, use and regulation of biological systems for remediation of contaminated environments land, air, water, for environment-friendly processes (green manufacturing technologies and sustainable development).

The applications of biotechnology are so broad and the advantages are so effective, that virtually every industry is using this technology. Developments are underway in areas as diverse as pharmaceuticals, diagnostics, textiles, aquaculture, forestry, chemicals, household products, environmental clean-up, food processing and forensics to name a few. Biotechnology is enabling these industries to make new or better products, often with greater speed, efficiency and flexibility. Biotechnology holds significant promise to the future.

Biotechnology involves the modification of the basic genetic material in living things namely DNA , which imparts new properties and capabilities in organisms including plants, animals and micro organisms which can be harnessed for a number of useful applications.

Vast changes to facilitate growth in this sector are taking place in the country.

Approximately, 60% of the industry is devoted to human health applications, 10% to agricultural biotechnology and 30% to industrial applications, bioinformatics and genomics. The Recombinant DNA (rDNA) technology is being successfully used in various sectors such as agriculture, health care, process industry and environment management. The current focus is on genomics, proteomics, transgenics, stem cell research and product development.

Opportunities In India

- Foreign companies may partner with India at the drug discovery stage of research, and use the Indian companies for contract research and manufacturing. This is because an increasing number of large pharmaceutical companies are finding it difficult to conduct the entire drug discovery process-in-house. India on the other hand provides a cheaper infrastructure. This has

given rise to contract research organizations specialising in drug discovery services. Contract research services are largely focused on molecular biology, bioinformatics, genomics & stem cell research. Clinical research and trials are expected to grow exponentially over the next 5 years.

- There are tremendous opportunities in India for data-mining, gene annotation, and the development of software interfaces. These require:
- enormous computing power for which India has established its supremacy.
- Foreign companies may form joint ventures with Indian companies, or enter into technology transfer agreements or strategic research partnerships with key research institutions.
- The Indian market provides opportunities to produce and sell vaccines and therapeutics that respond to the needs of the millions of poor in India.
- In the agricultural biotechnology sector, with the approval for commercial release of first genetically modified product (Bt Cotton), India is expected to approve other crops, including mustard, soyabeans, corn and potatoes, in the near future.

Strengths

- Trained manpower and knowledge base
- Good network of research laboratories
- Rich Biodiversity: India's human gene pools offer an exciting opportunity for genomics.
- Well developed base industries (e.g.: pharmaceuticals, seeds)
- Access to intellectual resources of Non-residents Indians in this area
- Extensive clinical trials and research and access to vast & diverse disease population

Weaknesses

- Lack of venture capital
- Relatively low R&D expenditure by industry

Steps Taken By Indian Government

- The Indian government has entered into a number of biotechnology co-operation agreements with various countries in an effort to foster additional growth in this sector.
- Several State Governments such as Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra have taken out their specific policies to boost the biotechnology sector in their respective areas. Some of the key steps taken by the State Governments include: announcing separate Biotechnology Policy for their States, setting up of Task Forces with experts to guide them on policy issues, setting up of exclusive Biotechnology Parks with agriculture and health

biotechnology as key areas. The city of Bangalore, located in the State of Karnataka and known as the IT capital of India, is emerging as the hub of Biotechnology industry in India.

Key Methods Of Doing Business In India

A new entrant to the Indian market should consider one of the following options, depending on the expected volume of business, the nature of business (whether it's an active pharma ingredient/generic bulk drug or a pharma product), market potential and its long term strategy for the Indian market.

1. *A foreign company may appoint a distributor* as this is the ideal entry option, which does not require much in the way of resources. But the selection of the right distributor is essential. For most industrial products, one exclusive indenting agent or distributor is the most common arrangement.

2. *A foreign company may open its Liaison Office in India.* However, a liaison office is not allowed to transact any business. It could only undertake market development activities. Expenses of this type of office must be met through inward remittances from the Head Office abroad. The Reserve Bank of India (RBI) grants approval for the opening of such offices.

3. *Opening of a Branch Office* by foreign companies engaged in manufacturing and trading activities abroad is another option available to undertake buying and selling activities in India. A branch office may render technical support and professional consultancy services but it is not allowed to undertake manufacturing activities. Permission from the RBI is required to set up this type of office.

4. *Joint Venture/Wholly Owned Subsidiary:* A foreign company can commence operations in India through incorporation of a company under the provisions of the Indian Companies Act (1956).

Regulatory Framework In India

Department of Biotechnology [DBT] constituted under the Ministry of Science and Technology is the nodal agency for policy, promotion of R&D, international cooperation and manufacturing activities. Together with DBT, Genetic Engineering and Approval Committee [GEAC] constituted under Ministry of Environment and Forests [MoEF] is the leading regulatory body in the area of Biotechnology in India. Several committees have also been constituted under the said ministries to regulate the activities involving handling, manufacture, storage, testing, and release of genetic modified materials in India. These committees have

statutory authority. Most of the committee members are from the scientific community and staff of DBT and MoEF. DBT appoints the members to the committees. The GEAC is supposed to be assisted by the *State Biotechnology Coordination Committees* (SBCC) and *District Level Committees* (DLC).

The most important committees are:

- The *Institutional Biosafety Committees* (IBSC), responsible for the local implementation of guidelines,
- *Review Committee on Genetic Manipulations* (RCGM) responsible for issuing permits;
- *GEAC* responsible for monitoring the large scale and commercial use of transgenic materials.

The Biotechnology industry in India is governed by the following enactments depending upon their relevance/applicability on case to case basis:

1. Environment Protection Act, 1986
2. EXIM Policy
3. Foreign Exchange Management Act, 1999
4. Laws pertaining to Intellectual Property Rights
5. Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Micro Organisms/Genetically Engineered Organisms or Cells, 1989 notified by Ministry of Environment & Forests on December 5, 1989 under Environment and Protection Act, 1986.
6. Revised Recombinant DNA Safety Guidelines
7. Guidelines for Research in Transgenic Plants & Guidelines for Toxity and Allergenicity Evaluation of Transgenic Seeds, Plants and Plant Parts, 1998
8. National Seed Policy, 2002
9. Seeds Act, 1966
10. The Plants, Fruits and Seeds [Regulation of import in India] Order 1989 issued under the Destructive Insects and Pests Act, 1914.
11. Guidelines for Generating Preclinical and Clinical Data for rDNA Therapeutics, 1999
12. Drugs & Cosmetic Act 1940 along with Drugs and Cosmetic Rules
13. Drug Policy, 2002
14. Biological Diversity Act

Agricultural Biotechnology

Foreign Direct Investment

Under the Foreign Direct Investment [FDI] Scheme of the Government of India, a person resident outside India [including foreign companies, Non-Resident Indians (NRIs) and Overseas Corporate Bodies (OCBs)] can invest in the Indian company not engaged in agriculture including plantation by way of subscription of up to 100% of its shares, without obtaining any prior approval provided that the person resident outside India does not have a previous financial or technical collaboration in India.

Under the automatic route of the RBI, an Indian company may issue shares to the person resident outside India provided:

- that the Indian company does not require an industrial licence under the provisions of the Industrial [Development & Regulation] Act, 1951 or under the locational policy notified by the Government of India under the Industrial Policy; and
- the shares of the Indian company are not being issued with a view to acquiring existing shares of any Indian company.

If the person resident outside India has a previous financial or technical collaboration or a trademark agreement in India in the same or allied field in which the Indian company is engaged, then the approval of the Ministry of Finance, is required to be obtained prior to making any investment. Also, if the shares are being issued with a view to acquiring the existing shares of the Indian company, prior approval of the Ministry of Finance and thereafter, of RBI is required. Ministry of Finance approval takes about 4-6 weeks and RBI approval takes about 2 weeks.

Agricultural Biotechnology: Procedural Aspects

The initiation and execution of any research project, production activity and field trials are preceded by necessary procedures of notification and approval of competent authority including IBSC, GEAC depending on the nature of the project and activities.

"Recombinant DNA Safety Guidelines, 1990" were released by Department of Biotechnology which cover areas of research involving genetically engineered organism and these guidelines were further revised in 1994. The revised guidelines are in respect of safety measures for the research activities, large scale use and also the environmental impact during field applications of genetically altered material.

Further, "Research in Transgenic Plants & Guidelines for Toxity and Allergenicity Evaluation of Transgenic Seeds, Plants and Plant Parts, 1998" *[Guidelines]* specifically covers

rDNA research on plants including the development of transgenic plants and their growth in soil for molecular and field evaluation. The guidelines also deal with import and shipment of genetic modified plants for research use.

Under the said guidelines, the following clearances are required:

Institutional Biosafety Committee (IBSC):

IBSC is the nodal point of interaction within a commercial organisation/applicant company involved in rDNA research for the implementation of rDNA guidelines. Therefore, in the first instance, applicant company intending to carry out research activities involving genetic manipulation of microorganisms should constitute IBSC comprising of the Head of the applicant company, scientists involved in DNA work, a medical expert and a nominee of the DBT.

All recombinant research carried out by the applicant company shall designate a Principal Investigator [PI].

i. In case of Category I routine recombinant experiments mentioned in the guidelines, the PI is required to intimate to the IBSC in the prescribed proforma.

ii In case of Category II experiments, the PI shall seek permission of IBSC before starting the experiment. IBSC shall intimate its decision to the RCGM before execution of the experiments and RCGM shall put the information on record.

iii. Category III experiments, where the risk involved in the experiments are considered to be of higher magnitude having the potential of polluting/endangering the environment, the biosphere, the eco system, the animals and the human beings could be conducted only after obtaining clearance from RCGM and upon being notified by the DBT.

All experiments conducted in green house and open field conditions not belonging to the Category II, would fall under Category III.

Therefore, IBSC shall review and give clearance to the project proposals falling under the restricted category that meets the requirements under the guidelines. Where the clearance from the RCGM is required, IBSC shall forward its report to the RCGM after screening along with its recommendation.

Review Committee on Genetic Manipulation (RCGM)

The RCGM under the DBT comprises of representatives of a) DBT; b) Indian Council for Medical Research; c) Indian Council for Agricultural Research; d) Council for Scientific and Industrial Research; and e) other experts in their individual capacity.

Before conducting the research in rDNA work involving risk categorized as category III and above under these guidelines, the PI/Applicant is required to obtain the permission of RCGM following approval from the IBSC. After reviewing the application, the RCGM may recommend the application to Monitoring cum Evaluation Committee [MEC] of the DBT for agronomic benefits and evaluation. After detailed deliberations, the MEC recommends the modified application back to RCGM. For making its evaluations and recommendations, MEC may visit trial sites, analyze data, inspect facilities and conduct environmental risk assessments.

An applicant shall also seek the permission of the RCGM for conducting green house trials and small-scale field trials to generate data to assess the safety of GM/transgenic crops that are intended to be released into open fields. The safety studies include environmental safety studies (pollen flow, emergence of volunteers, persistence etc.), food safety studies (toxity, allergenicity, pathogen drug resistance, alteration of nutritional value etc.], and the assessment of agronomic advantage over non-transgenic crops.

Large-scale field trials would also require the approval of the GEAC.

Genetic Engineering Approval Committee (GEAC):

In case of large scale field trials, deregulation and commercialization, in addition to the DBT approval process mentioned above, permission of GEAC constituted under the MoEF is also required.

Precisely, approval of the GEAC is required from the environmental angle on:

i. Import, export, transport, manufacture, process, selling of any microorganisms or genetically engineered substances or cells including food stuffs and additives that contain products derived by gene therapy.

ii. Discharge of genetically engineered/classified organisms/cells from Laboratory, hospitals and related areas into environment.

iii. Large scale use of genetically engineered organisms/classified microorganisms in industrial production and applications. Production can only be commenced after obtaining such approval.

iv. Deliberate release of genetically engineered organisms.

All approvals of GEAC shall be for a specified period not exceeding 4 years at the first instance renewable for 2 years at a time.

Import and Shipment of Transgenic Material

All imports of seeds and planting material etc. will be allowed freely subject to EXIM Policy guidelines and the requirements of the Plants, Fruits and Seeds (Regulation of Import into India) Order, 1989 and shall require a permit granted by the Plant Protection Advisor to the Government of India.

In addition, permits authorizing the import or receipt of regulated materials for research and specifying the conditions under which the agent or vector is shipped, handled and used are issued by RCGM. The RCGM issues the import certificate after looking into the documents related to the safety of the material and the national need. Based on such import permit issued by DBT on the recommendations of RCGM, the importer has to apply to the National Bureau of Plant Genetic Resources [NBPGR] for phytosanitary clearance after which the transgenic crops/seeds can be imported. Large scale imports also require the approval of GEAC.

The import consignment is required to be accompanied by an appropriate phyto-sanitary certificate issued by the authority of the country of export regarding their transgenic character or otherwise. The consignment on arrival at entry point would be inspected by Plant Protection Advisor, who after inspection, fumigation, disinfection or disinfestation, will accord quarantine clearance for the entry of the crops into India.

Commercialization of GM/Transgenic Crops in India

Transgenic crops/varieties are tested to determine their agronomic value for at least two seasons under the All India Coordinated Project Trials of ICAR, in coordination with the tests for environment and bio-safety clearance as per EPA before any variety is commercially released in the market. Based on such trials and recommendation, GEAC shall inform its decision to the concerned administrative ministry/ authorize body and also inform the applicant to follow the relevant acts.

After the transgenic plant variety is commercially released, its seed is required to be registered and marketed in India as per the provisions of the Seeds Act. After commercial release of a transgenic plant variety, its performance in the field, will be monitored for at least 3-5 years by the Ministry of Agriculture and State Departments of Agriculture.

Medical/ Pharmaceutical Biotechnology

Foreign Direct Investment

Under the FDI Scheme of the Government of India, person resident outside India can invest up to 100% under the automatic route of the RBI by way of subscription of the shares in

the share capital of the Indian company engaged in the manufacture of drugs and pharmaceuticals provided that the activity does not attract compulsory licensing or involve the use of recombinant DNA technology and specific cell/tissues targeted formulations.

Industrial licensing under the Industrial [Development & Regulation] Act, 1951 is compulsory for:

- bulk drugs produced by the use of recombinant DNA technology;
- bulk drugs requiring in-vivo use of nucleic acids as the active principles; and
- specific cell/tissue targeted formulations.

Therefore, investment in Indian companies engaged in the manufacture of licensable drugs and pharmaceuticals and bulk drugs produced by recombinant DNA technology requiring in-vivo use of nucleic acids, and specific cell/tissue targeted formulations, will require prior regulatory approval of the MINISTRY OF FINANCE . Human cloning is not allowed as a matter of principle.

Automatic permission is also given by the Government for Foreign Technology Agreements for all bulk drugs cleared by Drug Controller General of India [DCGI] which satisfy the standard conditions attached to such approvals, except in case of above mentioned products.

Pharmaceutical Biotechnology: Procedural Aspects

In the pharmaceutical biotechnology sector, approvals are required for the following purposes, apart from other statutory approvals:

-Research & Development

-Manufacture

-Imports

Research & Development

For carrying out research and development in the field of recombinant DNA, the applicant company is required to submit the rDNA research proposal to IBSC constituted by it. The said proposal shall contain the prescribed particulars viz., rationale, molecular biology of genetically modified organisms, containment facility, risk management.

IBSC shall make an application to RCGM for seeking its permission for experiments (up to 20 litres of capacity). RCGM upon giving its approval shall also intimate its decision to State Biotechnology Coordination Committee (SBCC) and Drug Controller General of India (DCGI).

Manufacture

The manufacture of a new drug of rDNA base involves the following steps:

1. Production of Test Batch Invitro Characterisation

Firstly, an application is required to be made to the DCGI seeking permission to manufacture trial batches of the drug. Five such batches of drugs are manufactured upon obtaining such permission and the batches are characterized as physico chemical, biological and contaminants.

2. Conducting Animal Trials (Preclinical Studies)

The objectives of the preclinical studies are to define physiological, toxicological and efficacious potential of rDNA product prior to initiation of human studies. The preclinical studies begin with the formulation of animal testing protocol. An application is then required to be made to the Institutional Animal Ethics Committee (IAEC) seeking permission to conduct animal trials and for approval of the protocol so developed. After obtaining such permission, proposal is submitted to RCGM for animal study.

3. Conducting Human Trials (Clinical Studies)

A necessary pre-requisite for a clinical study/trial is that pre-clinical data must provide sufficient evidence of potential safety of the product through animal studies. The clinical studies are conducted in following three phases:

Phase I : It involves preliminary evaluation of safety of drug in healthy volunteers.

Phase II : It involves initial efficacy trial on small number of patients.

Phase III : It involves assessment of safety and efficacy of large scale multicentric trials on patients.

The initiation of clinical study begins with the development of a protocol in consultation with the study center and the same must be approved by the Institutional Ethics Committee (IEC). Thereafter, application for Phase I of the clinical studies is required to be submitted to RCGM and DCGI. Such an application is accompanied by IEC approval, study center details and pre-clinical trial report. Application is reviewed and approval is given by RCGM and DCGI. Thereafter, application is required to be made to DCGI for next phase trial along with the necessary data.

Application is then made to the GEAC for clearance from environmental angle along with Phase III clinical data. The GEAC may approve the application subject to conditions it may impose in this regard.

Thereafter, subject to the reports of testing, permission may be given by DCGI and the concerned state authority to manufacture and market the drug as per the Drugs and Cosmetics Act, 1940.

Import of rDNA Drugs

Imports of drugs and pharmaceuticals is governed as per EXIM policy in force and the Drugs and Cosmetics Act, 1940 and Rules made thereunder.

Permission/Licence for import of rDNA drugs requires the making of an application to GEAC for clearance from environmental angle. After obtaining such approval, application is made to DCGI for import permission for a test batch. Trials shall be required to be conducted and stage of trials shall depend upon the product approval stage in the country of origin, usage, exposure of Indian population.

Trial data is then submitted to GEAC and DCGI and permission to import and market the drug is given as per the Drugs and Cosmetics Act, 1940.

Biosafety Regulations

Potential risks are associated with the use of genetically modified organisms in both agriculture and healthcare to human health, environment and biological diversity. Many countries have developed biosafety regulations to address these risks. There have been initiatives to harmonize biosafety regulations by international organizations. The most ambitious attempt to produce a globally harmonized regime for biosafety has been under the Convention on Biological Diversity (CBD). The Cartagena Protocol on Biosafety was negotiated and adopted under the aegis of CBD on January 29, 2000. The protocol seeks to protect biological diversity from the potential risks posed by living modified organisms. India is a party to the CBD and a signatory to Cartagena Protocol on Biosafety and has also decided to ratify the same.

Presently, India has rDNA Safety Guidelines, 1990, which were revised in 1994. The revised guidelines prescribe bio-safety measures which must be undertaken in India both for contained research activities, large scale environmental release of genetically altered agricultural and pharmaceutical materials and also for screening transgenic plants and seeds for toxicity and allergenicity. The guidelines are to be followed prior to the commercial release of genetically modified technologies.

Intellectual Property Rights Protection And Biotechnology

Being a signatory to the Trade Related Intellectual Property Rights [TRIPs] Agreement of WTO, India has amended its legislations pertaining to intellectual property through various legislations including Patents (Amendment) Act, 1999, formulation of Protection of Plant Varieties and Farmers Rights Act, 2001 [PVP Act].

The current system in India allows patent protection on methods and processes of substances intended for use or capable of being used as food, medicine or drug and not on the end result/product itself. Companies are therefore able to study the end product and produce it using an unpatented processing method. However, in keeping with the TRIPS provision, it is now possible to file application for patent in India on product claims relating to drug/medicinal product and obtaining of priority date for such invention with effect from January 1, 1995 as amended by Patents (Amendment) Act, 1999. These applications are categorized as Mail Box applications and shall not be processed until the end of 2004 due to transition period of 10 years. However, Exclusive Marketing Rights (EMR) can be obtained based on such applications.

TRIPs Agreement allow countries to formulate their own sui generis regime for plants as an alternative to patent protection. To fulfill its commitment, India has passed PVP Act on plant variety protection that incorporates intellectual property rights. This law recognizes farmers' rights and adapts some relevant provisions of UPOV 1978 and 1991 versions, based on the realities and requirements of India as an agriculture-based economy that equally recognizes the contribution of farming communities and private investments in the development of new plant varieties. The PVP Act provides for protection of registered varieties of plants for-- 15 years for annual crops and 18 years for trees and vines and includes the exclusive right to produce, sell, market, distribute, import or export the variety or its propagating material and to licence other persons to do the same.

Present position is that UPOV has allowed India to join the 1978 provisions of the treaty and India has also decided to be a member of the same.

The Biological Diversity Act is India's effort to interpret the Convention of Biodiversity. The Act aims to establish a National Biological Authority (NBA) with powers to protect biological resources in all ecozones within the country, provide approval to foreign agents to access biological resources or inventions derived from them and their exports. It further stipulates that before seeking any form of intellectual property rights on an invention based on India's biological resources, prior permission of the authority constituted under the Act must be

obtained. Such authority will have the power to impose conditions to ensure a share of profits accruing from the intellectual property rights of the biological resources. Biological resources have been defined to include plants, animals and micro-organisms, or parts thereof, their genetic material and by-products, for actual or potential use, but do not include human genetic material.

Tax Incentives

- A company engaged in the business of biotechnology and incurring any expenditure on scientific research (not being in the nature of cost of any land or building) on in-house research and development facility as approved by the prescribed authority is allowed deduction of 150% of the expenditure so incurred.

For the purpose of above deduction, 'expenditure on scientific research', in relation to drugs and pharmaceuticals shall include expenditure incurred on clinical drug trial, obtaining approval from any regulatory authority under any Central, State or Provisional Act and filing an application for a patent under the Patents Act, 1970.

- Tax holiday has been extended to Indian companies carrying on scientific research & development which obtain approval from the prescribed authority upto 31 March 2004. The amount of deduction for such companies is 100% of the profits & gains of such business for a period of 10 consecutive assessment years, beginning from the initial assessment year, if such company fulfills such conditions as may be prescribed.
- Some Indian States offer concessional or nominal sales tax rates for "high end" new biotechnology products, as may be notified by the respective State Government, manufactured by units located within biotechnology parks established within those States.
- All units including those dealing with biotechnology products are eligible to avail of Export Oriented Units (EOU) Scheme or Export Processing Zones (EPZ) Scheme. Such units are eligible to import free of duty all types of goods including captive power plants, raw materials and components, prototypes, office equipment and consumables for office use, material handling equipment, except those contained in the negative list. The entire production of EOU/EPZ units shall have to be exported except for permitted levels of rejects and domestic sales. The unit should be a net foreign exchange earner. It shall have minimum net foreign exchange earning as a percentage of exports (NFEP) as specified in the policy and minimum export performance (EP) of US $ 0.50 Million or 3 times the CIF value of imported capital goods, whichever is higher for five years. Such units are also eligible to get deduction of specified percentage of profits from its

total income (90% for the assessment year 2003-04) for calculation of corporate tax till the assessment year 2009-10 and is also eligible to get reimbursement/exemption from other indirect taxes.

Conclusion

The biotechnology industry in India is an emerging industry with significant promise for growth. There is a solid base of expertise in the country and strong government support for the industry at both national and State levels, which provides appropriate opportunities for investment in the biotechnology sector.

TOPIC NO. 6

NUCLEAR TECHNOLOGY AND LAW

1. Introduction

The developments after the World War I were marked as an era of rapid advancements in the field of technology and cheap energy. With the passage of time in the middle of the 20th century, sustainable development programmes, use of renewable sources of energy was being propagated. Nuclear accidents at Three Mile Island in March 1974 and Chernobyl in April 1986, in which 65,000 people died and the damages went as high as US $250 billion, made the public apprehensive of nuclear energy; it was a realization of the potential catastrophe that lies close beneath the nuclear reactors. These accidents proved that they have serious consequences on the property, economy, environment and health of the people. The environmental movements were giving little comfort to the public who were already fearful of the harms that would be caused to them and their family in case of nuclear accidents. However, by end of 1990s and beginning of the twenty first century, radioactivity was being replaced by global warming as more imminent and dangerous environmental threat in the public eye. Growing concern over global warming has now put a veil of respectability on nuclear energy as carbon emissions from a nuclear power plant are trifling.

The Nuclear reactors and nuclear power plants have been in operation without any large public concerns and issues for more than three decades now. They are making a significant contribution in the world's energy and some countries have turned their back on developing nuclear weapons program and expansion of nuclear power program, after a strong opposition for the use of nuclear power. The emergence of serious issues like global warming, reducing

greenhouse gas emissions, along with concerns about depletion of fossil fuels, use of renewable sources of energy, energy security led to the development of nuclear power in the developed and developing countries of the world.

Energy security has been an integral part of foreign and security policy objectives of all nations, ever since the First World War when British navy converted its ships from coal to oil propulsion to gain advantage over German ships powered by coal. Several major battles fought during the Second World War, including the 1941 German attack on Russia and Japan's decision to attack the US naval base in Pearl Harbor at the end of that year, were directly or indirectly related to the energy security.

2. Growth of Nuclear Power in India

Nuclear power accounts for a small fraction of the total commercial primary energy consumed within India. Used for generating electricity, nuclear power accounts for a very negligible amount of the total electricity generated within India. In spite of its small current contribution, nuclear power has the potential to offer India 'energy independence' beyond 2050 and hence its development is seen as crucial. However, India is endowed with low concentrations of poor quality uranium ores but with large quantities of thorium ores. Consequently, India's nuclear-generation programme is based on a three-stage plan-(i) Pressurized Heavy Water Reactors, (ii) Fast Breeder Reactors; and (iii) Reactors based on the Uranium 233-Thorium 232 cycles- aimed eventually at the exploitation of the country's vast thorium reserves. However, as a non-signatory to the nuclear Non-Proliferation Treaty (NPT) and having conducted nuclear tests in 1974 and 1998, India has been under international sanctions to access its nuclear materials and technology from abroad. The future development of nuclear power within India is dependent on civilian nuclear commerce with the international community. The International Atomic Energy Agency (IAEA) was established in 1956 with the main objective of encouraging and facilitating the spread of nuclear power. It was presumed that atomic energy would contribute to 'peace, health and prosperity' throughout the world. According to the objectives of IAEA health and environmental risks would be managed by various legal systems themselves by formulating rules and regulations taking into account guidelines on safety measures set up by IAEA.

3. Nuclear Power: The Emergence of Environmental Concerns

It was the popularity of nuclear power as an answer to the oil crises of the 1970s which ultimately brought long term health and environmental consequences to the forefront of international concern. The Stockholm Conference in 1972 had called for a registry of emissions of radioactivity and international co-operation on radioactive waste disposal and reprocessing. It recognized that the latter was a growing problem, caused by the increasing use of nuclear power, but offered no clear policy guidelines. Oceanic dumping of nuclear waste was partially banned in 1972, suspended entirely in 1983, and banned outright by the 1996 Protocol revising the London Dumping Convention leaving disposal on land or reprocessing as the only viable option. But nuclear reactors accident at Three Mile Island in the USA and Chernobyl in the Soviet Union showed how serious were the risks for health, agriculture and the environment posed by nuclear power. Spreading contamination over a wide area of Eastern and Western Europe, the accident at Chernobyl in1986 revealed the limitations of international policy for containing catastrophic risks, and some of the true costs of nuclear power.

Chernobyl cast doubt on the adequacy of national and international regulation of nuclear facilities. It showed how limited were the powers of IAEA, and how little agreement existed on questions of liability and state responsibility. It gave new importance to the interest of neighbouring states in the setting of nuclear power plants, the opportunities for consultation on issues of safety, and the right to prompt notification of harmful accidents. It became evident that the initial compassionate view about nuclear power which was adopted in 1950 needed more emphasis on stronger international control of safety matters.

4. Importance of Nuclear Power and Challenges in India

A new chapter about nuclear power has been written in the last 10-15 years. Increased competition over fossil fuels, and global concerns over climate change have prompted many legal systems to shift to nuclear energy. Indeed, the World Nuclear Industry Status Report 2010–2011 states that there were more nuclear reactors under construction worldwide in 2010 than in any year since 1988. Whereas in 2014, the number of operational reactors in the world has dropped by 39 (9 percent) from 427 in July 2013 to 388 in July 2014, this is 50 fewer than at the peak in the year 2002. The shift to nuclear energy is particularly strong in the energy-starved but fast-growing economies of China, India and South Korea. In fact, India has drawn up an ambitious plan to reach a nuclear power capacity of 63,000 MW in 2032 and it has been repeatedly asserted

by the Indian Government that nuclear energy will play an important role in the country's quest for a clean and environmentally friendly energy mix. However, even as the global nuclear energy industry and the Asian countries have been bracing for this renaissance, the recent accident at Fukushima in 2011 has served a stark reminder of the capacity of nuclear power to inflict catastrophic damage and the need for stringent safety norms. Not surprisingly, scholars and experts have accorded considerable attention to formulation of appropriate safety regulation for civil nuclear installations.

India has achieved a healthy economic rate at 8% per annum. In order to sustain this growth rate, the country requires emphasis on creation of infrastructure and enhanced supply of input (such as energy). The total commercial energy requirement in India is estimated to increase by 7.5 times in the next thirty years, but the current growth rate is a meager 3.29%. It is also important that the energy that is created does not pollute the environment, considering the imminent danger of climate change and environmental pollution. This is possible by using renewable energy sources as well as by using nuclear fuels. The current sources of energy creation in India are as given below.

Table 1: All India Energy Sector at a Glance (as on 31.03.2015)

Fuel	**MW**	**Percentage (%)**
Total Thermal	188,898	70.6
• Coal	164,636	61.5
• Gas	23,062	8.6
• Oil	1,200	0.4
Hydro (Renewable)	41,267	15.4
Nuclear	5,780	2.2
Renewable Energy Sources	31,692	11.8
Total	2,67,637	

Over the years, most of the energy that is produced in India is from hydropower stations coupled with thermal power stations. At the same time, energy production from nuclear power

stations witnessed a negative growth even though the National Electricity Policy, 2005 portrays a need for increase in the share of nuclear power significantly by enhancing public sector investments. The overall growth rate of energy in thermal, hydro and nuclear sector is 6.04% in 2013-14 and 2014-15 (provisional) is 8.4%. The category wise generation performance is as follows:

Table 2: Overview of Power Generation in India (2013-14)

Energy	**Improved/Declined**	**Percentage (%)**
Thermal	Improved by	4.18
Hydro (Renewable)	Improved by	18.58
Nuclear	Improved by	4.14
Overall growth rate	Improved by	6.04

Nuclear power constitutes approximately 16% of the world's electricity. In the year 2009 alone more than 15% of the world's electricity came from nuclear power. Apart from this, more than 150 naval vessels have been built using nuclear propulsion around the world. At present India has nineteen nuclear power plants in operation generating 4,560 MW with 4 others are under construction and are expected to generate an additional 2,720 MW of energy. India is also envisaging an increase of contribution of nuclear power to overall electricity generation capacity from 4.2% to 9% within 25 years. According to the official report, India has an ambitious plan to reach a nuclear power capacity of 63,000 MW by 2032. However, this aim has been challenged by the recent public protests against establishment of new nuclear power plants. For example, a 9900 MW Nuclear Power Project at Jaitapur, in the state of Maharashtra and another 2000 MW Nuclear Power Plant at Koodankulam, in the Indian State of Tamil Nadu has seen unprecedented public protest. Similarly the state government of West Bengal has refused permission to a proposed 6000 MW plant at Haripur citing safety concerns. In the background of removal of global sanctions and growing energy need of the country and increase in nuclear commerce, the

Indian Parliament has passed the Civil Liability for Nuclear Damage Act, 2010 to put a definite mechanism in place to deal with compensation claims arising from a nuclear accident. After the bill was passed in Lok Sabha, Prime Minister Manmohan Singh said that the occasion signaled the 'completion of a journey to end the apartheid against India in the field of atomic power. However, the issue is not merely the amount of compensation to be paid in the event of an accident, but who would encumber the bill, whether the operators or the suppliers, and to what extent.

5. International Atomic Energy Agency as an International Inspectorate and Review Body

International Atomic Energy Agency (IAEA) was the product of compromise following failure to agree on the proposals proposed by US for international single head management of all nuclear power plants by an international body. Its main tasks were confined to encouraging and facilitating the development and inspection of nuclear power, and ensuring through the non-proliferation safeguards that it was used only for peaceful purposes. It had the important responsibility to set the standards for health and safety of humans in collaboration with other international agencies. IAEA has only limited power to act as an important nuclear safety inspectorate under its statute. However, the Agency can, if requested, also provide safety advice and a review of safety practices for any nuclear installation or waste disposal site.

The IAEA has laid down certain principles to be followed by its member states for nuclear safety and precautions.

They principles are as follows:

(a) The Safety Principle: This principle lays emphasis that the legal regimes in a country should adopt certain minimum standards of safety for the purposes of protecting health and minimize the danger to life and property from exposure to radiation. This principle is further divided into two subsidiary principles. They are as follows:

(i) Prevention and Protection Principle: This principle lays down that every legal regime should adopt standards of safety for radiation protection, transport and handling of radioactive materials, radioactive waste disposal and safety of nuclear installations**.**

(ii) Precautionary Principle: This principle lays emphasis on establishing basic

international minimum safety standards and guiding principles regulating the design, construction, siting and operation of nuclear power plants. The utmost priority should be given to protecting public health, security, safety and the environment.

(b) Security Principle: The Security Principle suggests the legal system should include the provisions against, both accidental and intentional radiation which can pose threat to the life and property of the people. This principle also cautions against illegal acquisition of nuclear materials by criminal or terrorist groups.

(c) Responsibility Principle: When there are Trans boundary nuclear accidents, it becomes difficult to find most preferred method for ensuring safety and reallocating the costs for accident. Generally, the principle of equal access and non discrimination to nuclear risks and a number of national legal systems facilitate trans-boundary proceedings.

(d) Permission Principle: Prior permission is required to do those things, which may pose serious threat or injury to persons or environment. Use of nuclear technology inherently involves some risk, prior permission is always required. The law also clearly needs to identify those activities that require prior permission.

(e) Continuous Control Principle: A continuous monitoring of the activities to provide safety advice and a review of safety practices for any nuclear installation or waste disposal site. IAEA safety inspections are valuable to governments because of their independence and the reassurance they provide. **Compensation Principle**: The states should create a common scheme for loss distribution among the victims, focusing liability on the operator of a nuclear installation, based on the principle of absolute or strict liability and re-inforced by state-funded compensation schemes.

(f) Sustainable Development Principle: The principle of sustainable development has special relevance in nuclear energy production. It is "because some fissile material and sources of ionizing radiation can pose health, safety and environmental risks for very long periods of time."

(g) Compliance Principle: Nuclear energy production involves particular risks of radiological contamination transcending national boundaries. There are many bilateral and multilateral instruments that aim at determining an international law of nuclear energy. The fundamental question is to what extent a particular state has adhered to these international legal regimes. It is also important that the national legal regime incorporates the provisions of

customary international law also.

(h) Independence Principle: It is very important that the powers, functions and decisions of the Regulatory Authority that is constituted under the nuclear law are not interfered by the executive or other branches of the State and also from entities involved in the development or promotion of nuclear energy.

(i) Transparency Principle: Erstwhile, information of nuclear materials was guarded, categorizing it as 'sensitive' and 'confidential'. In the recent past, however, the emphasis is "with the development of the peaceful uses of nuclear energy, however, public understanding of and confidence in the technology have required that the public, the media, legislatures and other interested bodies be provided with the fullest possible information concerning the risks and benefits of using various nuclear related techniques.

6. The Civil Liability for Nuclear Damage Act, 2010

Operators of nuclear establishments are liable as per law for any damage caused by them. The liability of operators is not based on fault principle but on the principle of no fault or strict liability, regardless of fault. This damage will have its impact not only in the country of the disaster but also in the neighbouring countries as well. Normally to certain extend the operators of the plants/nuclear establishments are made liable for the damage, which they may pay through insurance. Beyond that, according to international law and practice, States accept responsibility as the insurer of the last resort.

Currently there are three major international agreements, which form the international framework of nuclear liability. They are:

(a) The Paris Convention of 1960.

(b) The Vienna Convention of 1963 along with the Protocol to amend the Vienna Convention, 1997.

(c) The Convention on Supplementary Compensation for Nuclear Damage of 1997.

Among these conventions, India is a signatory to only the Convention on Supplementary Compensation for Nuclear Damage, but she has signed few bilateral agreements with other countries, including USA, UK, Russia, France, and Canada, for co-operation in using of nuclear energy for civilian purposes. The India-France bilateral agreement explicitly states that India has to create a civil nuclear liability regime for compensating damage caused by incidents involving

nuclear material and nuclear facilities.

Even though there are more than four hundred nuclear reactors operating worldwide, there have been only three major accidents in nuclear reactors in which human lives have been lost. However, damage caused in a major nuclear accident, such as Chernobyl, was disastrous. The objective of Civil Liability for Nuclear Damage Act, 2010 is to provide quick compensation in the event of such a nuclear tragedy. International agreements have certain common features to address this issue:

(a) Fixing no-fault liability on operators and requiring them to take insurance or provide financial security.

(b) Limiting no-fault liability in time and amount.

(c) There is a process for expeditious distribution to victims by fixing which court/ authority has jurisdiction.

The Civil Liability for Nuclear damage Act, 2010 received the president's assent on 21st September 2010. The main purpose of this legislation is to provide for civil liability for nuclear damage and give prompt compensation to the victims of a nuclear incident through a no-fault liability regime channeling liability to the operator and also on the State. This Act also aims at appointing a Claims Commissioner and establishment of a Nuclear Damage Claims Commission. It is also stated that it is being enacted to provide for liability arising out of a nuclear incident, and also due to the "necessity of joining an international liability regime.

The Act applies to nuclear damage suffered in or over the maritime areas beyond the territorial waters of India, in or over the exclusive economic zone, on board or by a ship registered in India or on or by an artificial island, installation or structure under the jurisdiction in India. At the same time it applies only to the nuclear installation owned or controlled by the Central Government either by itself or through any authority or corporation established by it or a government company.

Liability for Nuclear Damage

Chapter II of the Act, (sections 3 to 8) lays down the law and procedures on the liability for nuclear damage. Within 15 days from the occurrence of any nuclear incident, the Atomic Energy Regulatory Board (AERB) shall notify a nuclear incident if it feels that the gravity of the threat and risk involved is not *insignificant*. Once notified, the Board shall also give wide

publicity to the incident so that people can be cautious and take all the necessary precaution. However the word 'insignificant' that is used in this section seems to be confusing. It gives room for the AERB to determine what is significant and what is not significant as there are no criteria laid down.

For any such nuclear incident the Operator shall be liable for the resultant 'Nuclear Damage' if it involves the 'nuclear installation' or 'nuclear materials' under its control. Where there is more than one operator and damage attributable to each operator is not separable, the liability of each operator shall be 'Joint and Several.' However even in case of such joint and several liabilities, the total liability of such operator shall be as specified under section 6(2). At the same time if there are several nuclear installations by the same operator that are involved in a nuclear incident, such operator shall, in respect of each such nuclear installation be separately liable to the extent pre-scribed under section 6 (2).

Liability of an Operator to be 'Strict Liability' based on the principle of 'No-Fault Liability'

The Indian version of strict liability, the 'absolute liability' principle, stipulates that "where an enterprise is engaged in a hazardous or inherently dangerous activity and harm results to anyone on account of an accident in the operation of such hazardous or inherently dangerous activity resulting, for example, in escape of toxic gas, the enterprise is strictly and absolutely liable to compensate all those who are affected by the accident and such liability is not subject to any of the exceptions which operate *vis-à-vis* the tortious principle of strict liability under the rule in *Rylands* v. *Fletcher*"[59] In other words absolute liability is strict liability without any exception. This liability standard has been laid down by the Indian Supreme Court in *M.C. Mehta* v. *Union of India (Oleum Gas Leak Case)*[60].

(a) However, the nature of liability in the event of a nuclear catastrophe in India is not prescribed. The Act itself provides for certain exceptional circumstances under which an operator shall not be liable (however, even under these circumstances the victim will get compensation as the liability is transferred to the Central Government). These circumstances are as follows: A grave natural disaster of an exceptional character. However the phrase 'exceptional character'

[59] (1868) LR 3HL 330.
[60] AIR 1987 SC 1086

has not been defined under the Act. This leaves a lot of discretion with the authorities.

(b) An act of armed conflict, hostility, civil war, insurrection or terrorism.

If these circumstances directly cause the nuclear damage, the Central Government assumes liability instead of the operator. Further the list continues to include any nuclear damage that is caused to:

(a) The nuclear installation itself and any other nuclear installation, fully or partially constructed, on the site where such incident occurred.

(b) To any property on the same site which is used or to be used in connection with such installation.

(c) To the means of transport upon which the nuclear materials involved was carried at the time of nuclear incident.

These provisions, though aimed at preventing the operator from getting compensation for nuclear incident caused by him, may go against the interest of another party whose property at the time of the nuclear incident was on the same site.

Advantages and disadvantages of nuclear power

In this section we analyze the advantages and disadvantages of nuclear power. Nevertheless, most organizations related to nuclear energy are already positioned for or against the use of nuclear power. On this site we try to make an objective analysis about this question, giving all the relevant information and offering a space for different conclusions.

Advantages of nuclear power

The generation of electricity through nuclear energy reduces the amount of energy generated from fossil fuels (coal and oil). Less use of fossil fuels means lowering greenhouse gas emissions (CO_2 and others).

Currently, fossil fuels are consumed faster than they are produced, so in the next future these resources may be reduced or the price may increase becoming inaccessible for most of the population.

Another advantage is the required amount of fuel: less fuel offers more energy. It represents a significant save on raw materials but also in transport, handling and extraction of nuclear fuel. The cost of nuclear fuel (overall uranium) is 20% of the cost of energy generated.

The production of electric energy is continuous. A nuclear power plant is generating electricity for almost 90% of annual time. It reduces the price volatility of other fuels such as petrol.

This continuity benefits the electrical planning. Nuclear power does not depends on natural aspects. It's a solutions for the main disadvantage of renewable energy, like solar energy or eolic energy, because the hours of sun or wind does not always coincide with the hours with more energy demand.

It's an alternative to fossil fuels, so the consumption of fuels such as coal or oil is reduced. This reduction of coal and oil consumption benefits the situation of global warming and global climate change. By reducing the consumption of fossil fuels we also improve the quality of the air affecting the disease and quality of life.

1. Relatively Low Costs

The initial construction costs of nuclear power plants are large. On top of this, when the power plants first have been built, we are left with the costs to enrich and process the nuclear fuel (e.g. uranium), control and get rid of nuclear waste, as well as the maintenance of the plant. The reason this is under advantages is that nuclear energy is cost-competitive. Generating electricity in nuclear reactors is cheaper than electricity generating from oil, gas and coal, not to speak of the renewable energy sources!

2. Base Load Energy

Nuclear power plants provide a stable base load of energy. This can work synergistic with renewable energy sources such as wind and solar. The electricity production from the plants can be lowered when good wind and solar resources are available and cranked up when the demand is high.

3. Low Pollution

It is in most cases more beneficial, in terms of the climate crisis, to replace other energy harnessing methods we use today with nuclear power. The environmental effects of nuclear power are relatively light compared to those. However, nuclear waste is potential harmful for both humans and the environment.

4. Thorium

Reports show that with the yearly fuel consumption of today’s nuclear power plants, we have enough uranium for 80 years. It is possible to fuel nuclear power plants with other fuel types than uranium. Thorium, which also is a greener alternative, has lately been given an increased amount

of attention. China, Russia and India have already plans to start using thorium to fuel their reactors in the near future.

It looks like nuclear fuel is of good availability if we combine the reserves of the different types together. In other words, hopefully enough time for us to find cost-competitive greener ways of harnessing energy.

5. Sustainable

Is nuclear energy renewable or non-renewable? This is a good question. By definition, nuclear energy is not a renewable energy source. As I mentioned above, there is a limited amount of fuel for nuclear power available. On the other hand, you could argue that nuclear energy is potentially sustainable by the use of breeder reactors and fusion reactors. Nuclear fusion is the holy grail of harnessing energy. If we can learn to control atomic fusion, the same reactions as those that fuel the sun, we have practically unlimited energy. At the moment, these two methods both have serious challenges that need to be dealt with if we are to start using them on larger scale.

6. High Energy Density

It is estimated the amount of energy released in a nuclear fission reaction is ten million times greater than the amount released in burning a fossil fuel atom (e.g. oil and gas). Therefore, the amount of fuel required in a nuclear power plant is much smaller compared to those of other types of power plants.

Disadvantages of nuclear power

We've previously discussed the advantage of using nuclear energy to reduce fossil fuel consumption. Organizations often use this argument in favor of nuclear energy but it's a partial truth. Much of the consumption of fossil fuels is due to road transport, used in heat engines(cars, trucks, etc.). Savings in fossil fuel for power generation is fairly low.

Despite the high level of sophistication of the safety systems of nuclear power plants the human aspect has always an impact. Facing an unexpected event or managing a nuclear accident we don't have any guarantee that decisions we took are always the best. Two good examples are Chernobyl and Fukushima.

The Chernobyl nuclear accident is, by far, the worst nuclear accident in the history. Different wrong decisions during the management of the nuclear plant caused a big nuclear explosion.

Referring to the Fukushima nuclear accident, the operations done by the staff were highly

questionable. Fukushima nuclear accident is the second worst accident in the history.

One of the main disadvantages is the difficulty in the management of nuclear waste. It takes many years to eliminate its radioactivity and risks.

The constructed nuclear reactors have an expiration date. Then, they've to be dismantled, so that main countries producing nuclear energy could maintain a regular number of operating reactors. They've to built about 80 new nuclear reactors during the next ten years.

Nuclear plants have a limited life. The investment for the construction of a nuclear plant is very high and must be recovered as soon as possible, so it raises the cost of electricity generated. In other words, the energy generated is cheap compared to the cost of fuel, but the recovery of its construction is much more expensive.

Nuclear power plants are objectives of terrorist organizations.

Nuclear power plants generate external dependence. Not many countries have uranium mines and not all the countries have nuclear technology, so they have to hire both things overseas.

Current nuclear reactors work by fission nuclear reactions. These chain reactions is generated in case control systems fail, generating continous reactions causing a radioactive explosion that would be virtually impossible to contain.

Probably the most alarming disadvantage is the use of the nuclear power in the military industry. The first use of nuclear power was the creation of two nuclear bombs dropped on Japan during World War II. This was the first and the last time that nuclear power was used in a military attack. Later, several countries signed the Nuclear Non-Proliferation Treaty, but the risk that nuclear weapons could be used in the future will always exist.

Advantages of nuclear fusion versus nuclear fission

Currently the generation of electricity in nuclear reactors is done by nuclear fission reactions. For the moment, nuclear fusion is not valid to generate electric power. Once developed, ifnuclear fusion is really practicable, it will provide great advantages over nuclear fission:

- Virtually inexhaustible sources of fuel.
- No accidents in the reactor due to the chain reactions that occur in fissions.
- The waste generated will be much less radioactive.

While the advantages of using nuclear energy seem to be many, there are also plenty of negative effects of nuclear energy. The following are the most important ones:

1. Accidents Happen

The radioactive waste can possess a threat to the environment and is dangerous for humans. We all remember the Chernobyl accident, where the harmful effects of nuclear radiation on humans can even be witnessed today. Estimates conclude that somewhere between 15 000 and 30 000 people lost their lifes in the Chernobyl aftermath and more than 2.5 million Ukrainians are still struggling with health problems related to nuclear waste.

Just last year, on March 18, a major nuclear crisis happenend again in Japan. While the casualties were not as high as with the Chernobyl accident, the environmental effects were disasterous.

History shows that we can never really protect us 100% against these disasters. Accidents do happen.

2. Radioactive Waste

Does nuclear power cause air pollution? The nuclear power plants emit negligible amounts, if any, **carbon dioxide** into the atmosphere. However, the processes in the nuclear fuel chain such as mining, enrichment and waste management does.

7. Conclusion

Nuclear energy has seen tremendous growth in the last few decades, riding mostly on the growing concern in international community about global warming. All international liability regimes for nuclear damage share two common features *i.e.,* channeling liability to the operator and capping this liability and transferring the final responsibility to compensate the victims to the government. Relieving the supplier from all liability in case of a nuclear accident carries with itself high risks, essentially leaving less incentive for the supplier to design safer nuclear plants.

In the Indian civil nuclear liability regime, apart from channeling liability to the operator, capping this liability and transferring the final responsibility to compensate the victims to the government, the operator has been given a right of recourse against the supplier if the nuclear incident has resulted as a consequences of equipment or material with patent defects or latent defects or substandard services supplied by the supplier. It is indeed a substantial departure from the international best practices but this departure is more than justified as it makes suppliers accountable in nuclear commerce and minimizes the risks of relieving supplier from all liabilities.