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Bioethics on biotechnology and on conservation of biodiversity

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Abstract

Although scientific knowledge is present on an overwhelming scale in nature and therefore its discovery is unceasing, this does not mean that as a human being the researcher has no limitations. It is Bioethics that sets that limit. The successful spreading of knowledge therefore should also pursue the establishment of the bioethical principles necessary for the credibility of science & technology and its progress so that the societies that it promotes and sustains become a reality. Bioethics relates to the consideration of ethical challenges arising from advances in biological, biotechnological and medical sciences. Bioethical concerns, however, are not only restricted to issues directly related to the notion of human life, but also to issues related to the general sphere of every living being's life. Hence, biodiversity conservation has become a focal point of both the international, national, and local societal concern and also central in the bioethical debate. Technology should be always tempered by ethical principles, should be achieved by ethically acceptable means and employed for ethically acceptable ends.

Keywords: Biodiversity, bioethics, biotechnology, science & technology, discovery.

Introduction

Should we, or should not we? Ethical questions deal with the effects our actions or inactions have on the world around us. If something is harmful, we shouldn't do it. A simple enough guideline in theory, but one that's not very useful when the consequences of an activity are not yet clear, or when it's effects can be both harmful or helpful. Biotechnology (advancement of science and technology) falls into this ambiguous camp. Bioethics relates to the consideration of ethical challenges arising from advances in biological, biotechnological and medical sciences. Bioethics is both respect for life, and the process of making decisions that apply science and technology to life. The multidisciplinary field of bioethics aims to explore, discuss and analyze the moral

dilemmas arising from the techno-scientific development (Jonsen, 1993).

Bioethics

Bioethics is the study of the typically controversial ethical issues emerging from new situations and possibilities brought about by advances in science and technology. It is also moral discernment as it relates to medical policy, practice, and research. Bioethicists are concerned with the ethical questions that arise in the relationships among life sciences, biotechnology, medicine, politics, law, and philosophy.In broader meaning it represents a link between biology, ecology, medicine and human values in order to attain the survival of both human beings and other living species. It suggested that we need an ethics that can incorporate our obligations, not just to other humans, but to the biosphere as a whole. The term Bioethics (Greekbios, life; ethos, behavior) was coined in 1926 by Fritz Jahr, who "anticipated many of the arguments and discussions now current in biological research involving animals" in an article about the "bioethical imperative," as he called it, regarding the scientific use of animals and plants. In 1970, the American biochemist Van Rensselaer Potter also used the term in his book 'Bioethics, Bridge to the Future', with a broader meaning including solidarity towards the biosphere, thus generating a "global ethics," a discipline representing a link between biology, ecology, medicine and human values in order to attain the survival of both human beings and other animal species. It suggested that we need an ethics that can incorporate our obligations, not just to other humans, but to the biosphere as a whole.

Ethics vs. Morals

Ethics and morals relate to "right" and "wrong" conduct. While they are sometimes used interchangeably, they are different: ethics refer to rules provided by an external source, e.g., codes of conduct in workplaces or principles in religions. Morals refer to an individual's own principles regarding right and wrong.

Source of Principles

Ethics are external standards that are provided by institutions, groups, or culture to which an individual belongs. For example, lawyers, policemen, and doctors all have to follow an ethical code laid down by their profession, regardless of their own feelings or preferences. Ethics can also be considered a social system or a framework for acceptable behavior.

Consistency and Flexibility

Ethics are very consistent within a certain context, but can vary greatly between contexts. For example, the ethics of the medical profession in the 21st century are generally consistent and do not change from hospital to hospital, but they are different from the ethics of the 21st century legal profession. An individual's moral code is usually unchanging and consistent across all contexts, but it is also possible for certain events to radically change an individual's personal beliefs and values.

Conflicts between Ethics and Morals

One professional example of ethics conflicting with morals is the work of a

defense attorney. A lawyer's morals may tell him or her that murder is reprehensible and that murderers should be punished, but ethics as a professional lawyer, require defending his client to the best of his abilities, even if he knows that the client is guilty. Another example can be found in the medical field. In most parts of the world, a doctor may not euthanize a patient, even at the patient's request, as per ethical standards for health professionals. However, the same doctor may personally believe in a patient's right to die, as per the doctor's own morality.

Historical background of bioethics

When most people think of ethics (or morals), they think of rules for distinguishing between right and wrong, such as the Golden Rule ("Do unto others as you would have them do unto you"), a code of professional conduct like the Hippocrates Oath ("First of all, do no harm"), a religious creed like the Ten Commandments ("Thou Shalt not kill..."), or a wise aphorisms like the sayings of Confucius. This is the most common way of defining "ethics": norms for conductthat distinguish between acceptable and unacceptable behavior.

In August 1947, 15 Nazi physicians were convicted by one of the Nuremberg tribunals of immersing concentration-camp inmates in freezing solutions, exploding them in low-pressure chambers, infecting them with typhus, forcing them to drink sea water, and killing them in order to study their defleshed skeletons, all in the name of science. In deciding the case, the tribunal enunciated a set of ethical principles for experimentation with human subjects that came to be known as the Nuremberg Code.

The ten points of the Nuremberg Code

These are:

1. required is the voluntary, well-informed, understanding consent of the human subject in a full legal capacity.
2. The experiment should aim at positive results for society that cannot be procured in some other way.
3. It should be based on previous knowledge (like, an expectation derived from animal experiments) that justifies the experiment.
4. The experiment should be set up in a way that avoids unnecessary physical and mental suffering and injuries.
5. It should not be conducted when there is any reason to believe that it implies a risk of death or disabling injury.
6. The risks of the experiment should be in proportion to (that is, not exceed) the expected humanitarian benefits.
7. Preparations and facilities must be provided that adequately protect the subjects against the experiment's risks.
8. The staff that conduct or take part in the experiment must be fully trained and scientifically qualified.
9. The human subjects must be free to immediately quit the experiment at any point when they feel physically or mentally unable to go on.
10. Likewise, the medical staff must stop the experiment at any point when they observe that continuation would be dangerous.

Importance of science & technology

According to Bell (2001), biotechnology and genetic engineering are given great emphasis these days. The development of biotechnology results in effective researches in microbiology, biochemistry, enzymology and microbial genetics. The use of animal cells, such as cultured virus, plays a vital role in producing vaccine and monoclonal antibody from hybrid mass. Plants contribute to the production of clones of plants, synthesis of varied alkaloid and other secondary metabolites. Microbiology, genetic, molecular biology and biochemistry are the backbone of biotechnology (Ignacimuthu, 2008). The activities involved in biotechnology can be divided into eight major categories. The activities, together with their results, are presented below:

a) Genetic engineering and DNA recombination – enzyme, vaccine, hormone and antibody.

b) Cultured cell – single-cell protein, vaccine, monoclonal antibody and biomass product.

c) Sewage treatment and uses – cellulose and sewage water treatment.

d) Enzyme and biocatalysts – food processing, diagnostic kit, chemotherapy and biosensor.

e) Energy source – alcohol, hydrogen, methane and ethanol.

f) Nitrogen fixation – bio-fertilizer production.

g) Fermentation and pharmaceuticals – ethanol, antibiotic, vitamin, enzyme, amino acid and steroid.

h) Health care – DNA probe, gene therapy, antibiotic and hormone.

In 2000, the global income of modern biotechnological industry was estimated to be more than US$70 billion with pharmaceuticals contributing 60% of market value, whereas diagnostic 14% and enzyme industry 4% (Ignacimuthu, 2008). Biotechnological applications cover various aspects of human life and the scope is very wide. They include bioprocesses and fermentation technology, cultured cells, enzyme technology, the production of biological energy source, single-cell protein, sewage treatment, environmental biotechnology, medicinal biotechnology, agricultural and forestry biotechnology, food and beverage biotechnology, safety in biotechnology, good manufacturing practices (GMP), quality control in manufacturing, good laboratory practices (GLP) and marketing (Nair, 2004). Biotechnology is the technology of the 21st century and the key to future technologies. This field has great potential because it has the ability to resolve problems pertaining to science and humanity. The government is very serious about the biotechnological sector when a lot of opportunities and financial aids have been awarded to promote it. Since the government is giving particular emphasis on the development of biotechnology, we need to ensure that our health and environment remain intact. (Abu Bakar Abdul Majeed, 2002). Science and technology are valuable resources for man when they promote development for the benefit of all. Technology should be always tempered by ethical principles, should be achieved by ethically acceptable means and employed for ethically acceptable ends. The importance of ethics in all fields of science and technology is summarized by Jean-

Michel Baer, in his foreword to the 2010 European Textbook on Ethics in Research (Hunter 2010). He claims that "Ethics is of great importance to science and technology. There are many developments in science and technology that regularly give rise to ethical questions in European societies – stem cell research, genetically modified food, human cloning, gene therapy, stem cell research etc. The intense social debate such developments trigger, highlights the importance of high ethics standards for science and technology. These standards reflect our adherence to the ethical values and fundamental rights, such as human dignity, freedom, democracy, pluralism, solidarity, integrity and non-discrimination, on which the EU is founded". "High ethics standards also add to the quality of research, and increase its likely social impact".

Health and Biomedical Issues concerning Innovations

Reproduction, birth, life and death are significant and natural events in the lives of people.

Any intervention which will affect the spirit of what is natural and normal has to be studied carefully from a bioethical point of view.Examplesinclude issues related to - artificial insemination, in vitro fertilization and embryo transplants, surrogate motherhood, prenatal diagnosis and sex selection, abortion, euthanasia.

Many biomedical innovations related to health have various ethical implications e.g., issues related to organ transplantation, stem cells, recombinant bovine somatotropin(rBST), human genome project, gene therapy and cloning.

Here I want to throw some light on the examples of importance of ethical concern in the path of advancement of science & technology and also in conservation of biodiversity.

Ethical Implication of stem cell research & therapy

Stem cells are unspecialized or undifferentiated cellshave unique ability to give rise to many different cell types like skin, liver, kidney, heart, neuron, etc. These are pluripotent cells with capacity for prolonged self-renewal, can be induced to form different types of specialized somatic cells and tissues. Stem cells are of two types:

1. Adult stem cells (found in the bone marrow, blood stream, umbilical cord, cornea and retina of the eye, dental pulp of the tooth, liver, skin, G.I. tract, and pancreas) can differentiate into cell types of the tissue of origin.
2. Embryonic stem cellsare obtained from inner cell mass of blastocyst, mainly hollow ball of cells of three to five days embryo. Embryos can be created through in vitro fertilization (IVF) [Traditionally, IVF has allowed many otherwise infertile couples to have children].

Stem cell therapy is a promising area of research. The potential of application is the formation of cells and tissues that could be used to repair or replace damaged organs. This would enable doctors to treat many devastating and currently incurable diseases. Collection of adult stem cells from living humans (or from umbilical cord blood, preserved at birth) is generally considered as ethical, provided that the issues of informed consent and issues of ownership

are taken care of. In ownership issue, the ownership can be selected by contract agreement before any procedure takes place. If there are possibilities of patent grant, then the potential donors should be informed and if necessary included in the patent. There are strong ethical objections from various religious leaders and many countries about embryonic stem cells research. They consider embryos as potential human beings, and destroying embryos is equivalent to destroying life. In the near future, as the stem cell field progresses closer to the clinic, additional ethical issues are likely to arise concerning the clinical translation of basic stem cell knowledge into reasonably safe, effective, and accessible patient therapies.

Ethical Implication of BST story

The world is continuously progressing, and biotechnology has found ways to create an array of products in higher quantities, at unparalleled rates. However, the repercussions of such technology have caused controversy: one specific area of debate has been the use of bovine somatotropin (BST), a growth hormone which increases lactation levels in cattle. Prior to 1994, BST was only available from post-mortem extraction from the pituitaries of cows, making it impractical for general use; however, recombinant DNA technology has permitted for the development of recombinant bovine somatotropin (rBST). Recombinant DNA can be mass produced, meaning growth hormones could be used in unprecedented quantities. Although rBSTs may be superficially beneficial, some evidence suggests that the use of them produces more harm than good. Because of its negative ecological effect, minimal economic benefit and inherent ethical problems (potentially harming both cows and humans), the use of rBST should be limited, if not banned altogether.

Use of rBGH increases milk production in cows by about 11 percent and in some cases by up to 40 percent. This is the primary benefit associated with using rBGH; the increased production allows farmers either to sell more milk or own fewer cows, both of which lead to higher profits. Proponents of rBGH, including Monsanto and the FDA, assert there is no difference between milk produced by cows receiving rBGH and milk from cows that are not.

Ethical Implication on human genome project

The Human Genome Project (HGP) is an international scientific research project with the goal of determining the sequence of chemical base pairs which make up human DNA, and of identifying and mapping all of the genes of the human genome from both a physical and functional standpoint. It remains the world's largest collaborative biological project. The project was proposed and funded starting in 1984, got underway in 1990, and was declared complete in 2003. A parallel project was conducted outside of government by the Celera Corporation, or Celera Genomics, which was formally launched in 1998. Most of the government-sponsored sequencing was performed in twenty universities and research centers in the United States, the United Kingdom, Japan, France, Germany, and China. At the onset of the Human Genome Project several ethical, legal, and social concerns were raised in regards to

how increased knowledge of the human genome could be used to discriminate against people.

The list of questions being asked at the time included, "What should people know before having a genetic test? Who will have access to the information the test generates? How will that information be used? Who owns the genetic information stored in each individual's DNA? What is genetic discrimination?" The ethical issues fell into areas such as:

- Fairness in the use of genetic information by insurers, employers, courts, schools, adoption agencies, and the military, among others.
- Privacy and confidentiality of genetic information.
- Psychological impact and stigmatization due to an individual's genetic differences.
- Uncertainties associated with gene tests for susceptibilities and complex conditions (e.g., heart disease) linked to multiple genes and gene-environment interactions.

There was a common concern that individuals would be discriminated against "…because of differences in their DNA that increase their chances of getting a certain disease. For example, a health insurer might refuse to give coverage to a woman who has a DNA difference that raises her odds of getting breast cancer. Employers also could use DNA information to decide whether to hire or fire workers." As a result of these concerns and others, there was a push for federal legislation that would protect individuals from genetic discrimination. The Genetic Information Nondiscrimination Act (GINA), passed in 2008, prohibits discrimination on the basis of genetic information with respect to health insurance and employment.

Ethical Implication on human cloning

In bioethics, the ethics of cloning refers to a variety of ethical positions regarding the practice and possibilities of cloning, especially human cloning. While many of these views are religious in origin, the questions raised by cloning are faced by secular perspectives as well. Perspectives on human cloning are theoretical, as human therapeutic and reproductive cloning are not commercially used; animals are currently cloned in laboratories and in livestock production.

Advocates support development of therapeutic cloning in order to generate tissues and whole organs to treat patients who otherwise cannot obtain transplants, to avoid the need for immunosuppressive drugs, and to stave off the effects of aging. Advocates for reproductive cloning believe that parents who cannot otherwise procreate should have access to the technology. Opponents of cloning have concerns that technology is not yet developed enough to be safe, that it could be prone to abuse (leading to the generation of humans from whom organs and tissues would be harvested), and have concerns about how cloned individuals could integrate with families and with society at large.

Ethical concern in conversion of biodiversity

Biodiversity is the variety and differences among living organisms from all sources –

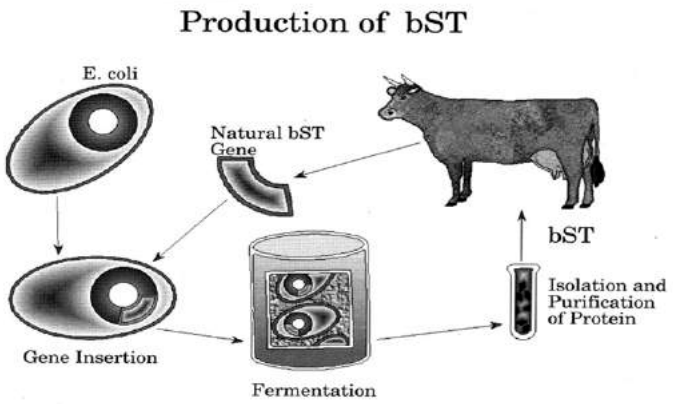

Fig.1.Production of bovine somatotropin by recombinant DNA technology.

terrestrial, atmosphere, marine and other ecosystems and the ecological complexes of which they are a part. This includes the genetic diversity also. According to Mora and colleagues, the total number of terrestrial species is estimated to be around 8.7 million while the number of oceanic species is much lower, estimated at 2.2 million.There is now unequivocal evidence that biodiversity loss reduces the efficiency by which ecological communities capture biologically essential resources, produce biomass, decompose and recycle biologically essential nutrients. There is mounting evidence that biodiversity increases the stability of ecosystem functions through time. Diverse communities are more productive because they contain key species that have a large influence on productivity, and differences in functional traits among organisms increase total resource capture. The impacts of diversity loss on ecological processes might be sufficiently large to rival the impacts of many other global drivers of environmental change. Maintaining multiple ecosystem processes at multiple places and times requires higher levels of biodiversity than does a single process at a single place and time. Conservation and sustainable use of biodiversity are required to feed the malnourished people in developing countries.

The various causes of biodiversity loss are

- Increasing demand for biological resources as a result of growing population, economic development and over-consumption.
- Failure of people to appreciate the consequences of inappropriate technology.
- Failure of economic markets to recognize the true value of biodiversity at local levels.
- Failure to recognize and address the problems associated with the over-use of biological resources.
- Increasing human migration, travel and international trade.
- Sourcing materials from indigenous people, converting into a product and selling it back for a high price, which the poor cannot afford.

(However, international and national regulations have come forward to reduce this kind of exploitation).

- Deterioration of the biodiversity and the environment as a result of rapid, indiscriminate and hasty adoption of technologies

Efforts to Preserve Biodiversity

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The Convention has three main goals:

1. Conservation of biological diversity (or biodiversity)
2. Sustainable use of its components and
3. Fair and equitable sharing of benefits arising from genetic resources.

In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. Apart from these Biological Diversity Act 2002 and Rules 2004 are in place by Govt of India with goals in line with those mentioned in the CBD. The objective is to give effect to the CBD as sought by people working in IPR and biodiversity conservation and also to protect and regulate access to plant and animal genetic resources and traditional knowledge (TK).

Conclusion

Life on this planet is a finely tuned delicate balance ofall forms of life– a balance created by millions of years of life, by millions of years of evolution .While science and technology must advance with an aimto benefit the society and improve the quality of human life,it is vital to create a balance in the efforts towardsmaking the world better and saving the planet earthwith all the wonderful gifts from the Nature. Immediate benefits are to be weighed against long range effects on man and the world of life as a whole. Science without conscience can only lead to man's ruin.

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