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The Human Ecology: Ethical Issues on Biotechnology with Particular Reference to Genetic Engineering of Nonhuman Organisms

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Abstract:

Biotechnology is one of the areas of science that uses the modification of living organisms for human purposes. This paper lays emphasis on agricultural biotechnology (genetic engineering of nonhuman organisms) which concerns the use of selective breeding to improve the production of crops and livestock to use them for food. It has been a subject of debate if biotechnology is beneficial or harmful to human beings? In reflecting on the origin of the universe, the human person and creation as God's creative work as our faith teaches us, the question that comes to mind is if biotechnology changes nature, modifies it or fosters its development? Was biotechnology invented for the wellbeing of humans? Is biotechnology a violation of nature? Does the power to intervene in nature and change it not dangerous to human life? Are genetically engineered foods beneficial to human life? Questions like these occupy our attention in this paper. This paper agrees with the teaching of the Church that nature is a gift offered gratuitously by the Creator to the human community, entrusted to intelligence and moral responsibility to humankind. The beauty and goodness of the Creator manifests in nature and in human beings, hence, human interventions that damage living beings or natural environment deserve condemnation while those that improve them are praiseworthy (Compendium of the Social Doctrine of the Church, 2005, no.473).

1. Introduction

We are in a world of change, a world that has been shaped with science and technology. Science tries to understand how things work. Over the centuries a lot of theories have been propounded in order to understand the origin of human existence. From this perspective, science began to clash with religion over the existence of God and the origin of human beings. Some scientists refute the idea of the existence of God as far as evolution is concerned. Different views have also been given especially in the field of theology about the relationship between faith and reason, science and religion. During his address to scientists, Pope John Paul II said that sciences have certain important and essential contributions to make directly or indirectly to spiritual characteristics of reality. But, as these contributions are made, their investigations and study need other complementary methods and disciplines such as those provided by arts, the humanities, philosophy and theology (John Paul II, 1985). This means that the understanding of the existence of the human being does not depend solely on one discipline.

Theology teaches us that nature is the work of God's creative action, and it is not a dangerous adversary. It is not also a sacred or divine reality that humans must leave alone. It is instead a gift which the Creator offered to the human community, and entrusted to their intelligence and moral responsibility (Compendium of the Social Doctrine of the Church 2005).

In nature we see the beauty and goodness of the Creator. The Creator has entrusted this nature to the creatures to use his/her intelligence and free will to develop and improve it. That is why according to Pope Francis (2015), St Francis of Assisi "invites us to see nature as a magnificent book in which God speaks and grants us a glimpse of his infinite beauty and goodness" (no. 12).

This article will give a brief overview of creation and human ecology, religion and science, the meaning of biotechnology; agricultural biotechnology; and ethical implications of agricultural biotechnology.

2. The Creation

The mystery of creation has been a crucial point of discussion since the trend of the modern science of evolution. From the earliest times, the human being has searched for the origin of the universe and his/her existence. Trying to understand the Creator and the creature occupies a central place in the life of the human person. The study of the mystery of creation can be look at from a realist perspective, from the point of view of reason and revelation, from Tradition, Scripture and the Magisterium.

The realist perspective of creation emphasizes that reality speaks to us by communicating its message through the human nature, shaped from flesh and spirit. This approach is based on the Thomist axiom which says that 'the being of a thing, not its truth, is the cause of truth in the intellect.' (Haffner, 1995). By implication it means that the Creator can be known through creation. Nature speaks to the mind about creation. Realism teaches that there exists an extra-mental world which exists independently of the mind of the knowing subject. This world can be known as it is in itself. The realist perspective is about metaphysical presuppositions of creation which alone cannot explain in entirety the creation. It means philosophy alone cannot tell us about creation because it is shrouded in mystery.

Through reason, we study the creation in search of its Creator, and through revelation God enters his own creation in search the creature. And through faith and theology, the Creator and the creature, God and the human meet within the setting of the universe (Haffner, 1995). By divine revelation God wished to manifest and communicate himself and the eternal decrees of his will regarding the salvation of humankind. It means therefore, that he wished “to share with us divine benefits which entirely surpass the powers of the human mind to understand.” And “God, the first principle and last end of all things, can be known with certainty from the created world, by the natural light of human reason” (Vatican II *Dei Verbum*, 1995, no. 6).

In Christian tradition the knowledge of God the Creator has been known through two sources, namely the Book of Scriptures and that of the universe. The fact that creation reveals something of the Creator can be called natural revelation and it is distinct from supernatural revelation. Creation and revelation are intertwined because while creation reveals something of God and his plan, revelation invites us to intimate relationship with God against the background of what he has made. God therefore, reveals himself both through creation and through his Son, and the ways and degrees of this revelation are different. By looking at the creation, we can learn something of the contours of him who made all (Haffner, 1995). For instance, the scientists have proved that the earth is a globe spinning round on its own, and there are other planets that are thousand miles far away from the earth. All these including the solar systems make up the universe. The question that immediately comes to mind goes thus, how is it that the earth is just spinning round on its own and nothing holds it? How is it that the sun which is about ninety three thousand million miles away from the earth gives light to it? There are a lot of questions which only science or natural reason cannot give. Creation is a mystery that beyond human reasoning.

Scripture and Tradition are two sources that teach about creation. Sacred Scripture and Tradition make up a single sacred deposit of the Word of God which is entrusted to the Church. The sacred Scripture in the Book of Genesis teaches that God created the world out of nothing. In the theology of creation, the Church believes that “God created the world according to his wisdom. It is not the product of any necessity whatever, nor of blind fate or chance... God needs no pre-existent thing or any help in order to create, nor is creation any sort of necessary emanation from the divine substance. God creates freely “out of nothing” (Catechism of the Catholic Church, nos. 295-296). The Church in its faith and theology does not derive the fullness of the content of revelation and the certainty pertaining to this deposit of faith from Scripture alone, but also all that is contained within the Tradition of the Church. For instance, from the theology of creation the doctrine of creation out of nothing is indicated in the Scriptures, but the complete doctrine and its certainty is contained in the Tradition as taught by the Church’s teaching office or magisterium (Haffner, 1995).

- By the word of the Lord the heavens were made” (Ps 33:6). This tells us that the world came about as the result of a decision, not from chaos or chance, and this exalts it all the more. The creating word expresses a free choice. The universe did not emerge as the result of arbitrary omnipotence, a show of force or a desire for self-assertion (Pope Francis, 2015, no. 77).

In the biblical account of creation, after God had created everything and saw they were good, he created the human being. He placed the human being at the centre and in charge of everything he had made.

- It is God who made all things, and with regard to each created reality “God saw that it was good” (cf. Gen 1:4,10,12,18,21,25). At the summit of this creation which “was very good” (Gen 1:31), God placed man. Only man and woman, among all creatures, were made by God “in his own image” (Gen 1:27). The Lord entrusted all of creation to their responsibility, charging them to care for its harmony and development (cf. Gen 1:26-30). This special bond with God explains the privileged position of the first human couple in the order of creation (Compendium of the Social Doctrine of the Church, 2005, no. 451).

3. Human Ecology

Human ecology studies the relationship between human beings and their natural, social, and built environments (wikipedia.org). In the first place, the human being who is created in the image of God, received a mandate to subject to oneself the earth and all that it contains, to govern it with justice and holiness, and relate oneself and the totality of things to the Lord and Creator of all (Compendium of the Social Doctrine of the Church, 2005, no. 456).

In his/her relationship with the environment, the human person is called to transform and develop the earth through his/her intelligence, activities and handwork. By so doing, he/she cooperates with God in the work of creation. But it should be noted that “our human ability to transform must proceed in line with God’s original gift of all that is” (Pope Francis, 2015, no.5).

4. Religion and Science

Many scientific thinkers believe that science and religion are two worlds apart and can never have anything in common. For them the universe exists without God’s intervention. As religion is concerned about the relationship of humans and the universe with God, science tries to find out how things work especially on the human relationship with the universe, thereby excluding God. But is religion opposed to science?

The major purpose of science was to ‘describe’ nature. Traditionally, this was what the scientists did by studying natural phenomena to understand them, and be able to formulate basic laws that stood behind nature and describe how it operated. However, two major events changed that orientation. The first event was the extension of applied research, mainly in physics, that led to the building and detonation of the atomic bomb. In this research therefore, the purpose was not so much to discover, describe, and then use the laws of nature to achieve a particular goal. The second event was the discovery and description of the structure of the DNA molecule by

Watson, Crick, and Franklin in 1953. This discovery led to significant developments in genetics which ended up in the recombination of genetic material from one organism into another to make a new being. These discoveries gave human beings the capacity to 'change' nature, to intervene at a basic and fundamental level into nature, including human life and change it according to their designs and wishes (Shannon and Kockler, 2009).

A physicist, Steven Weinberg (as cited in Haught, 1995) said that the deeper science looks into the nature of things, the less the universe seems to bear any imprint of an interested God. Another scientist of our century Albert Einstein (as cited in Haught, 1995) also argues that there is no personal deity who exists independently of the universe, as theistic religion maintains. For him the notion of a personal God is not only unnecessary for science but it is a primitive superstition that even religion can do without. And belief in a personal God is the bone of contention between science and religion.

One thing that is certain is that the existence of God (a personal God) is not an issue that science, including physics can ever resolve. For instance, physics leaves out anything that has to do with personality, attributes like intelligence, will, feeling, love, care, freedom, creativity, etc. Therefore, the existence of a personal God is an issue that science, including physics can ever resolve. Science works at high level of mathematical abstraction and its equations cannot be the appropriate means through which any divine love will be expressed in relation to the universe (Haught, 1995).

The theory by Charles Darwin on the "Origin of Species" now known as "evolution" does not only refute the biblical account of creation but completely ruled out the existence of God the Creator. Haught (1995) noted that the evolution theory updated by the discoveries of molecular biology has destroyed the belief of the divine designer that most educated people believed in prior to the middle of the last century. Before the publication of Darwin's on "Origins of Species" in 1859, two geologists James Hutton's "Theory of the Earth" (1759) and Charles Lyell's "Principles of Geology" (1830-1833) had already postulated that the earth was much older than biblical literalists assumed (McBrien, 2008). According to his evolution theory,

- Darwin observed that all living species produce more offspring than ever reach maturity. Nevertheless, the number of individuals in any given species remains fairly constant. This means that there must be a very high rate of mortality, since more young are produced than ever reach maturity. To explain why some survive and others do not, Darwin noted that the individuals of any species are not all identical: some are better "adapted" to their environment than others. It appears that the most "fit" are the ones that survive to produce offspring. The vast majority of individuals and species lose out in the struggle for existence, but during the long voyage of evolution there emerge a staggering diversity of life, millions of new species, and eventually the human race (Haught, 1995).

The implication of the above postulation reveals three inseparable ingredients; randomness, struggle, and blind natural selection, all seem to suggest that the universe is impersonal, and completely unrelated to any "interested" God. First of all the variations that lead to differentiation of species are purely *random*, thus suggesting that the workings of nature are "accidental" and irrational. Presently the source of the variations has been identified as genetic mutations, and most biologists still follow Darwin in attributing these to "chance." Secondly, the fact that individuals have to *struggle* for survival, and that most of them suffer and lose out in this contest, points to the basic cruelty of the universe, particularly toward the weak. Thirdly, the mindless process of *natural selection* by which only the better adapted organisms survive points to a universe that is essentially blind and indifferent to life and humanity (Haught, 1995). In essence, with the theory of evolution there is no place for the transcendent God, and a clear distinction between the Creator and the creatures, that is, God and human beings is created.

In recent times there have been serious questions raised with regard to the use of new forms of biotechnology in the areas of agriculture, animal farming, medicine and environmental protection. The new possibilities currently offered by biological and biogenetic techniques are a source of hope and enthusiasm on the one hand, and of alarm and hostility on the other hand (Compendium of the Social Doctrine of the Church, 2005). The following statement reveals to us that biotechnology could bring positive change and it could as well violate nature.

5. The Meaning of Biotechnology

According to the UN Convention on Biological Diversity, biotechnology could be defined as, "the use of living systems and organisms to develop or make products, or 'any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use'" (wikipedia.org). Biotechnology covers a wide range of procedures for modifying living organisms in accordance to human uses, through domestication of animals, cultivation of plants, and improvements to these through breeding programs that utilizes artificial selection and hybridization. The modern usage of biotechnology includes genetic engineering, cell and tissue culture technologies. It is widely believed that the term "biotechnology" was coined in 1919 by Hungarian engineer Károly Ereky. Later in the late 20th and early 21st centuries, biotechnology was expanded to include new and diverse sciences like genomic, recombinant gene techniques, applied immunology, development of pharmaceutical therapies and diagnostic tests (wikipedia.org). Biotechnology has applications in four major industrial areas. These are health care, crop production and agriculture, non food (industrial) uses of crops and other products, and environmental usage.

Genetic engineering refers to the modification of an organism's genetic composition by artificial means which involves the transfer of specific traits, or genes from one organism into a plant or animal of a completely different species (sustainable.org). Genetic engineering is also called genetic modification, and it is the direct manipulation of an organism's genome using biotechnology to change the genetic makeup of cells, as well as the transfer of genes within and across species boundaries to produce improved or new organisms (wikipedia.org). This is done by physically removing a gene from one organism and inserting it into another, giving it the

ability to express the trait encoded by that gene. For instance, it is like taking a single recipe out of a cookbook and placing it into another cookbook. For an understanding of genes, all life is made up of one or more cells. Each cell contains a nucleus, and inside each nucleus are strings of molecules called *DNA (deoxyribonucleic acid)*. Each strand of DNA is divided into small sections called genes. These genes contain a unique set of instructions that determine how the organism grows, develops, looks, and lives (sustainable.org).

The scope of this piece of writing is limited to agricultural biotechnology, hence the genetic engineering of nonhuman organisms.

6. Agricultural Biotechnology

Biotechnology was used by the earliest farmers to select and breed the best well-matched crops with the purpose of producing enough food to support a growing population. Animal and plant scientists used selective breeding to improve production of crops and livestock to use them for food. In selective breeding, organisms with desirable characteristics are mated to produce offspring with the same characteristics. For example, this technique was used with corn to produce largest and sweetest crops (wikipedia.org). This method or technique of selective breeding was used before the time of Charles Darwin, and it is nowadays known as traditional breeding. The goal of both genetic engineering and traditional plant breeding is to improve an organism's traits. The difference between them is that while genetic engineering manually moves genes from one organism to another, traditional breeding moves genes through mating, or crossing, the organisms in hopes of obtaining offspring with the desired combination of traits (sustainable.org).

In agricultural biotechnology, there are four basic plant-based genetic modifications. These include medicine-added plants, nutrition-added plants, protection-added plants, and production-added plants. For the medicine-added plants, plants are genetically engineered in such a way that infuses medicinal value. The main point here is the development of edible vaccines in plants like bananas or potatoes. The nutrition-added plants contain an added value that promotes good health in human beings. For example, the golden rice was genetically engineered to produce beta-carotene as a precursor to vitamin A deficiency. The developers did this to alleviate health problems as a result of malnutrition (e.g., blindness) caused by vitamin A deficiency. The foods that both medicine-added plants and nutrition-added plants produce are known as 'functional foods', and the enriched nature of these plants are referred to as 'biofortification'. Protection-added plants use genes for proteins that give greater protection against pesticides, herbicides, or pests themselves. An example of protection-added plants is the *Bt* corn and *Bt* cotton, which the scientists developed by splicing genes from the bacterium *Bacillus thuringiensis* that produces a toxic chemical to insect pests. Therefore, the plants themselves produce these toxins to ward off pesky pests on their own. The production-added plants utilize genes for proteins that increase farmers' yields or that allows the plants to grow in areas where they would ordinarily not be able to grow, such as desert areas (Shannon and Kockler, 2009). With the genetic engineering of protection-added plants, it means that farmers do not need pesticides or herbicides to treat the plants since the plants can produce it on their own.

Just like plants, animals can also be genetically engineered and it done through the same four categories as applied to plants; medicine-added animals, nutrition-added animals, protection-added animals, and production-added animals. The medicine-added animals contain genes that produce proteins, and this makes the animals clinically useful for human beings. For instance, scientists genetically engineer dairy cows to produce therapeutic proteins in milk. In producing nutrition-added animals, the animals have leaner meat or more nutritious meat. The protection-added animals were developed by the use of genetic engineering to confer disease resistance to farm animals. Hence, farmers would not depend much on veterinary interventions to save or to protect their livestock. Finally, in production-added animals, scientists spliced genes for proteins that promote a particular characteristic or add a new characteristic in which human beings are interested. For example, one may engineer dairy cattle to produce plenty milk without injecting specific hormone, engineer beef cattle to increase its yield (Shannon and Kockler, 2009). One can deduce from the above study that the primary aim of genetic engineering in plants and animals is to increase production in order to provide enough food to sustain the growing population. If that is the case, can one assert that agricultural biotechnology is the best for the wellbeing of human beings? Is agricultural biotechnology not a violation of nature? Does the power to intervene in nature and change it not dangerous to human life? Are genetically engineered foods beneficial to human life? In an attempt to search for answers to these probing questions, we shall look at the ethical implications of agricultural biotechnology.

7. Ethical Implications of Agricultural Biotechnology

Pope Francis (2015) in his encyclical *Laudato Si'* sees the possession of particular gifts for the advancement of science and technology as a God-given talent for the service of others. And he made it clear that the Church values the benefits which results from the study and applications of molecular biology, genetics and its application in agriculture and industry. But this should not lead to indiscriminate genetic manipulations. Moreover, "the misuse of creation begins when we no longer recognize any higher instance than ourselves, when we see nothing else but ourselves." It is to be recognized that "our human ability to transform reality must proceed in line with God's original gift of all that is" (nos.131 & 5).

There have been some studies on the usefulness of genetically engineered food and also its possible risks of harm to human beings. Pope Francis (2015) noted that it is difficult to make a general judgment about genetic modification of whether vegetable or animal, medical or agricultural because they vary greatly among themselves and call for specific considerations. But he further noted that he risks involved are not always due to the techniques used, but rather to their improper or excessive application.

It has been widely believed that genetic modification of nonhuman organisms, which is crops and animals, is beneficial to humans. By it, scientists can improve health care by using plants, animals or microbes to manufacture therapeutic proteins or other products. They

can also promote good nutrition for human beings by adding nutritional value (e.g. vitamins) to edible plants, and improve food production in impoverished areas of the developing nations (Shannon and Kockler, 2009).

The use of agricultural biotechnology has also brought about economic growth in some areas but it should be quickly pointed out that in some places due to the introduction of genetic mutation or modification of crops, productive land is concentrated in the hands of a few owner as a result of the progressive disappearance of small producers who are obliged to withdraw from direct production because of the loss of exploited lands. The temporary laborers and many rural workers are the most helpless and they end up moving to poverty-stricken urban areas. Besides, the expansion of crops has the effect of destroying the complex network of ecosystems, diminishing the diversity of production and affecting regional economies both presently and in the future (Pope Francis, 2015).

Strickland (2016) noted that by introducing genetic materials into crops, new allergies may be created. Pest-resistant crops might result to some problems. Farmers might use more chemicals to treat crops genetically engineered to resist poisons. These chemicals could build up toxins in the soil or seep into the groundwater. Genetically modified crops with toxic proteins designed to ward off pests could also affect other species. On the issue of health risks caused by allergies, Shannon and Kockler (2009) also pointed out that new substances in the genetically modified organism (GMO) or existing substances in it can induce a serious immune response.

Genetic engineering could result in diseases caused by new viruses or bacteria and also increased resistance to antibiotics. For instance, the use of recombinant bovine growth hormone (rBGH) to increase milk production has impact on both the cows and the human beings. Some veterinarians noted that the use of this hormone on cows puts stress on them, weakens their immune system and leads to infections of the udders. The consequence of this is an increased use of antibiotics to counter these infections. For humans, the impact would be on consumers. The increased levels of these antibiotics and their remains in the food chain could harm people who drink milk produced with rBGH. Apart from the above mentioned potential possible risks, the scientists are exposed to dangerous materials or pathogens which could harm them. There are also other arguments on the rights and welfare of other organisms, species integrity, and threats to biodiversity and the environment (Shannon and Kockler, 2009).

8. Conclusion

Biotechnology is an area of science that requires continuous research due to its complexity and relation to human life. From the research carried out, one discovers that the theory of scientific evolution which paved way to genetic engineering of both human and nonhuman organisms refutes the idea of the existence of God and his intervention in human history. The issue of genetic modification of organisms has brought about changes in the modern world, positive and alarming changes. According to Pope Francis (2015), "Change is something desirable, yet it becomes a source of anxiety when it causes harm to the world and to the quality of life of much of humanity" (no. 18).

The relationship between human ecology and biotechnology should be that of respect for human life, made in the image of God. Attitude should be that of openness and awe-inspiring love for creation. The beauty and goodness of the Creator manifests in nature and in human beings, therefore, human interventions should be towards the improvement of living beings and the natural environment. "If we approach nature and the environment without this openness to awe and wonder, if we no longer speak the language of fraternity and beauty in our relationship with the world, our attitude will be that of masters, consumers, ruthless exploiters, unable to set limits on their immediate needs. By contrast, if we feel intimately united with all that exists, then sobriety and care will well up spontaneously" (Pope Francis, 2015, no. 11). Science and religion are both needed for our human existence. As science helps us to understand better the natural environment, religion helps us to express outwardly this awesome wonders of creation.

9. References

- i. Einstein, A. (1954). *Ideas and Opinions*, New York: Bonaza Books.
- ii. John Paul II, (1985). *Address to the Participants on Cosmology*, Libreria Editrice Vaticana: Vatican City.
- iii. Haffner, P. (1995). *Mystery of Creation*, Herefordshire: Gracewing Fowler Write Books.
- iv. Haight, J.F. (1995). *Science & Religion. From Conflict to Conversation*, New York: Paulist Press.
- v. McBrien, R. (2008). *Catholicism*, India: St. Paul's.
- vi. Pope Francis, (24 May 2015). *Encyclical Letter Laudato Si' on the Care for our Common Home*. Libreria Editrice Vaticana: Vatican City.
- vii. Pontifical Council for Justice and Peace, (2005). *Compendium of the Social Doctrine of the Church*, India: Pualines.
- viii. Shannon, T.A., & Kockler, N.J. (2009). *An Introduction to Bioethics*, New York: Paulist Press.
- ix. Strickland, J., *What is Agricultural Biotechnology?* Retrieved March 16, 2016, from science.howstuffworks.com>life>genetic.
- x. *The Catechism of the Catholic Church*, (2002 Revised Edition) Kenya: Paulines Publication Africa.
- xi. Vatican II, *Dogmatic Constitution on Divine Revelation Dei Verbum* (18 Nov 1965).
- xii. Weinberg, S. (1992). *Dreams of Final Theory*, New York: Pantheon Books.
- xiii. *Human Ecology*. (n.d.) Retrieved March 13, 2016, from https://en.m.wikipedia.org/wiki/Human_ecology.
- xiv. *Biotechnology*. (n.d.) Retrieved March 17, 2016, from <https://en.m.wikipedia.org/wiki/Biotechnology>
- xv. <https://en.m.wikipedia.org>, Retrieved March 17, 2016.
- xvi. *Genetic Engineering* (n.d.). Retrieved March 16, 2016, from www.sustainable.org/264/geneticengineering.
- xvii. *Genetic Engineering*, (n.d.). Retrieved March 20, 2016, from http://en.wikipedia.org/wiki/Genetic_engineering.
- xviii. www.sustainable.org/264/geneticengineering Retrieved March 16, 2016.
- xix. <https://en.m.wikipedia.org> Retrieved March 17, 2016.