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# Death not the End: Some Scientific Reflections on Death

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*Abstract:* It is clear that the concept of death of each society played a crucial role in determining its goal of life, mode of life and values in life. The author first discuss some of the prevalent views of life and some of the impact they have had on the lives of people. Then he deals with some recent scientific developments related to like HGP, cloning. This leads him to comment on some issues critically and philosophically. These considerations point to a situation far beyond the purview of science, far beyond the competence of professional scientists. These matters are far too pregnant with grave consequences to be left in the hands of scientists alone. We need to develop a broader perspective and a broader approach. We need to develop new and effective ethical values to respond responsibly and creatively to this challenge, an ethics that will enable us to benefit from the advantages of science without having to suffer from the bad effects of technological developments, or at least enable us to maximize the blessings of science while at the same time minimizing its curses. The author believes that humanity are capable of achieving such a broad perspectives.

*Keywords:* Cloning, DNA, HGP, new ethics, physical immortality, understandings of death, Trans-homo Sapiens.

## Introduction: The Reality and Mystery of Death

The irony about death is that it is both a reality and a mystery at the same time. Although death is considered the most certain fact for any living being, there is no clear idea about what it is or when it will befall. Medical science has made tremendous strides in the medical care and treatment of patients. Yet, it is helpless when it comes to predicting the exact time of death even of the terminally

ill. Down through the ages different cultures, philosophies and religions have understood death differently. At the same time, it is clear that the concept of death of each society played a crucial role in determining its goal of life, mode of life and values in life. I discuss below some of the prevalent views of life and some of the impact they have had on the lives of people.

## 1. Death as the End of Life

This view was held by many from the beginning of civilization. According to this, death is the end of everything as far as the person is concerned. There is nothing beyond the grave. The Epicureans in the West, the Carvakas in India, the atheists and materialists in modern times subscribe to this view. For those who hold this view life on earth becomes the most important thing, and living the present life joyfully becomes their prime concern. Material pleasures and physical happiness become their primary goal. Ethical and moral values are looked upon from a mere pragmatic point of view.

## 2. Death as a Form of Enfeebled Life

For some societies life does not come to an end with death; rather it takes on another form, an enfeebled, scaled down form. This view was prevalent especially in Mesopotamia in ancient times. According to this view, a deceased person does not cease immediately, but rather goes down to the underworld gradually.

## 3. Death as a Continuation of Life

Yet another group looks upon death as a continuation of life. For them also life does not end with death, but continues on. Many tribal cultures subscribe to this view. For the Dayak of Borneo the soul returns to the earth after its 7$^{th}$ death, and enters into a mushroom or fruit near the village. When a lady eats that object, the soul invades the body of the woman and rebirth takes place.

## 4. Death as Perpetual Development

This is the evolutionary perspective of death. According to this view, life is an ongoing process, a never-ending process. Life is looked upon as an emergent quality from a universe that continues to transform itself. Similarly, the mind is also a quality that emerged from life. Sri Aurobindo, the Indian philosopher and mystic, held that the mind continued to evolve and develop into supermind.

## 5. The Scientific View of Death

Contemporary science in the light of its different findings, particularly in medical science, has developed a scientific view of death. In this context a few clarifications are in order. First of all, when science talks about death and immortality, it confines itself to the physical world. It means physical death and physical immortality. The spiritual dimension falls outside the purview of science, although in recent times much serious research has been going on to get a scientific understanding of the soul, immortality, etc. Secondly, there is much heated controversy about what physical death exactly means and when a person can be declared dead, scientifically speaking. Thirdly, science's criteria have to be limited to the phenomenal, functional, observational levels. Its criteria are empirical rather than metaphysical. Fourthly, recent developments in science have made the pplication of these criteria particularly complex. Thanks to these medico-technological developments, today science can enable a person to exercise certain vital brain functions even after the person is dead under normal conditions.

## Death as the Cessation of Brain Function

In the world of science, particularly medical science, death is often taken as the cessation of brain function. Even in this narrow definition there are controversies. For some death comes with the cessation of the higher brain function, whereas for some others it happens only when all brain functions cease.

In this context we need to consider the different parts of the brain such as the hindbrain, the midbrain and the forebrain. The hindbrain consists of the medulla, the pons and the cerebellum. The medulla is responsible for vital functions like breathing, heartbeat and digestion. Several cranial nerves enter the brain at the medulla. The pons is a way station for neural pathways going to other brain areas. The cerebellum, on the other hand, controls equilibrium, muscle tone and the regulation of coordinated movements. Furthermore, the function of the midbrain is to process sensory information from the eyes and ears. Both the hindbrain and midbrain together form the brainstem, which serves as a complex relay station for messages traveling up and down the spinal cord. The centre of brainstem and

just above it where it joins the forebrain are very basic parts of the brain since they are responsible for crucial functions like breathing, temperature regulation and basic emotional responses. Even this short description shows how complex the brain is, and how diverse its functions are. According to the scientific view, in order to be declared brain dead, one must have sustained irreversible cessation of all the functions of the entire brain, including the brain stem.[1]

Although the above definition of death looks quite reasonable, the matter has become highly complex today, leading to serious ethical dilemmas, because of developments in science and technology. Today patients can be given "heroic" treatment to restart hearts after they fail. In such cases can we say that the person is dead? This and similar cases are giving rise to ethical dilemmas that never existed before.

## Death and Recent Scientific Developments

Today science is no more confined to the laboratory or the drawing room of a handful of scientists. Science and its impact have become all-pervasive. Almost every aspect of human life has been touched, and in some cases transformed by science and technology. As I have argued in some other places, today science is in a position to determine not only what we have but also what we are.[2]

### The Human Genome Project(HGP)

The genome of any being is the sum-total of the genetic information locked up in its DNA. The HGP consists basically in identifying and locating the 3.1 billion nucleotides or chemical base units, arranged into around 30 thousand genes within the 23 pairs of chromosomes in the nucleus of the human cell. Human biological life can be compared to a book, "the book of life," written in a language made up of 4 letters A (Adenine), G (Guanine), C (Cytocine), and T (Thymine), which are biochemical units known as nucleotides. Human DNA consists of a long chain of these units repeated over 3.1 billion times in varying combinations. Genes are small, specific bits of this DNA, and can be compared to words formed by these letters. When the working draft of the human genome was announced in June of 2000, it was thought that the human DNA had 100,000 genes. Today it is found to be only 30,000

or less. These genes are primarily responsible for determining how humans will be, what characteristics they will have, how they will carry out their essential functions, etc. These genes are arranged into 23 pairs of chromosomes in the human cell.

The ordering or sequencing of the 3.1 billion chemical units is not arbitrary. Indeed, it contains absolutely vital instructions and information for sustaining life, since it determines the production of the all-important proteins. However, it is also found that the actual genes and the bits of DNA controlling the on/off switch of the protein-producing activity of the genes, account for a mere 5% of the total DNA in the cell. Some recent studies put it even less. The remaining massive chunk is left as "junk" since present day science has not yet been able to assign any definite function for it[3].

This code or series of instructions contained in DNA can be compared to the Morse Code used in telecommunications, which when decoded conveys important messages. Today many scientists in various parts of the world are busy decoding this message to understand it and apply it to different fields like medicine, nutrition, etc.

## The Importance and Implications of HGP

It is expected that in the future the genomic information of each individual will be available in CD or other inexpensive, user-friendly formats. This information, though absolutely fundamental and extremely useful, in itself can have only very limited impact on the individual and society. The situation can be compared to what happened in the physical sciences. Lord Rutherford's discovery of the structure of the atom was a trailblazer in the physical sciences. However, until it was combined with other theories and technological developments, it had only a limited impact. But when it was combined with breakthroughs in relativity, quantum theory, developments in nuclear and high-energy particle physics, etc., it could transform our understanding of material reality. It opened the way for nuclear power, better understanding of stellar phenomena, the origin of the universe, etc. It also spawned technologies like semi-conductors, transistors, radio, television, neon lights, lasers, etc., with numerous industrial applications. These developments transformed not only

the scientific world, but also the life style of even ordinary people all over the world. Similarly, when combined with other developments, technologies and techniques, such as genetic engineering, nanotechnology, computer and Artificial Intelligence (AI) technology, cloning, etc., the data provided by HGP can be a powerful force with far-reaching consequences for human destiny. We will discuss two such cases: the possibility of human immortality and of trans-human species.

## The Human Genome and Physical Immortality

Here we are concerned not with spiritual immortality or the immortality of the soul, but with bodily or physical immortality. Bodily immortality is something all humans, even the most desperate ones when in their good senses, look for, but find it impossible to attain. The average life span of humans has increased significantly in recent times, thanks to better medical knowledge, better medical facilities, better food and living conditions. Yet, living beyond 100 years seems to be almost an impossible dream.

Today the HGP, in tandem with advanced knowledge about the process of aging, genetic engineering, nanotechnology, telomerase[4] treatment and cloning, has opened up the real possibility for some form of physical immortality or at least a significant prolongation of life. It may be noted that immortality is the ultimate, idealistic goal which may never be really attained by science. The hope today at the practical level is that science in the future will be able to prolong the human life-span substantially.

A number of theories have been advanced in recent times to explain how the human body ages and finally dies after a certain number of years. For instance, the free radical theory says that the biological activities of the organism produce certain free radicals as by-products, which gradually destroy the healthy cells. When a certain number of cells in an organ are destroyed, it becomes non-functional and dies. The programmed senescence theory, on the other hand, holds that the rate at which living beings age is predetermined, the genetic makeup controlling the aging and death of the cells.

More recent studies reveal that death occurs because the process of cell division or replication ceases after a certain limit. It has been

found that under normal conditions a cell dies after 50 divisions. This limit is known as the Hayflick Limit.[5] Once a certain number of cells die the organs involved cease to function and the organism dies. Hence immortality research targets on slowing down, or even arresting, the process of cell deterioration.

Recent researches enable us to have a clearer idea about the process of cell deterioration. It is found today that cell life depends on telomeres which occur like caps at the ends of chromosomes, protecting the chromosomes from deterioration. Every cell division results in the shortening of the telomere. Gradually it gets depleted and the cell division stops. Obviously, a better and detailed knowledge of the genome can help in arresting, or at least controlling, the depletion of telomeres.

It has been found that the enzyme telomerase can prevent this shortening process. Hence better knowledge and utilization of this enzyme can be of great help in the search for possible physical immortality. Since telomeres are part of the chromosomes, genomic knowledge is vital for prolonging the life span using this method.

## Immortality/Long Life through Cloning

As has been pointed out, HGP in itself is incapable of prolonging the life span. But, in combination with cloning, nanotechnology and other techniques, it claims to be able to achieve this goal, although the actual realization will take a very long time and far more developments in technology. Long life can be made possible in two ways: by repair/replacement of defective parts and by cloning a living being just before its death.

Defective parts can be repaired by using nanotechnology which is technology at the molecular or atomic level. At present it is in the initial stages, but it is expected to develop rapidly in the coming years, thanks to parallel developments in computer and other technologies. Parts to be replaced in an organism can be obtained by cloning[6] although the morality of this process raises many serious questions. We are considering at the moment only the scientific possibility of this process. In this kind of replacement or transplantation of organs, the main difficulty is the rejection by the host. But if a clone is made by using the nucleus of the host itself

and a part from this clone is used for the transplantation, then the possibility of rejection is considerably reduced.

Transgenetic products also can be of great help in this context. This involves introducing into the DNA of one animal the genes of another living being. For instance, human genes can be introduced into a pig's DNA to produce a transgenetic animal, and its parts can be used for carrying out a transplant operation.

Another way to prolong life is by cloning the individual at the moment of death. Since cloning is claimed to produce an exact duplicate, the individual in a way continues to live through the clone.

In all these cases genomic knowledge is fundamental for the success of the process.

However, this process of cloning is beset with many problems. "Almost without exception, the world's experts in reproductive technology have agreed that cloning is not a safe way to try to produce a human baby.... It turns out, however, that creating cloned human embryos is more difficult than anyone imagined a decade ago."[7] Popular writings often give the impression that DNA is all that we need to produce an exact copy of a human being. Today it has been found that DNA has only a partial role. Epigenetics that control the activity of DNA also has an important role to play in forming the new being. "The job of DNA is to provide the instructions for building proteins, of which we are made. The job of epigenetic signals is to tell the DNA exactly how much of each protein to build at just the right time and in just the right cell."[8]

Again, at the time of fertilization the epigenetic signals are reset in order to bring about the complex process of development of the new being, whereas the DNA remains the same. When the new being is produced by cloning, there is no guarantee that the epigenetic signals will be reset. "In fact, all the evidence is that they are usually not set back to the starting point. The result can be catastrophic failure to develop properly."[9] A single consideration can reveal how serious and far-reaching the consequences can be. It has been found that in us human beings about 30% of the genes are expressed in our brains. The crucial step of brain development takes place in this way. Since epigenetic signals play a pivotal role in this process, if they fail, the being produced can be seriously defective.

## Comments and Reflections

### Humans as Co-creators

The HGP and other related developments in the biological sciences can be looked upon as a shot in the arm of human dignity since it raises humans from the level of mere creatures to that of co-creators or partners in the ongoing process of creation. The created world, despite being so breathtakingly amazing, still remains incomplete with almost infinite possibilities of further developments. Humans with their powerful resources of science are called upon to collaborate in completing this most sublime task. The HGP emphasizes this positive aspect of scientific developments.

### The Limits of HGP

Some of the claims made concerning the capabilities of HGP, especially by the non-professionals, are highly exaggerated. HGP has given us only the ordering and location of the nucleotides in the 23 pairs of human chromosomes. It is a long way from here to the actual production of human characteristics. As Phillip Sloan of Notre Dame University points out, "Working scientists and molecular biologists are fully aware of the enormous complexities that are interposed between the paired base sequences ... and the actual expression of phenomenal traits – e.g., blue eye colour, a nose of a specific shape, or a defined behavioural pattern."[10] This comes about because "even though each cell contains the same nuclear information in the form of DNA located on the chromosomes, between the DNA base sequence and expressed traits lies a very complex system of relationships involving regulator genes (operons), introns, exons, messenger and transfer RNA's, triplet codons, protein synthesis from specific amino acids, and time-dependent embryological formation of specific structures from proteins."[11] That is why metaphors like "blueprint," "code of life," etc., are misleading simplifications, since they imply direct causal connections, whereas the actual connections seem to be statistical.

### Reductionism

HGP and its claims are based on a strong reductionism – the sum of the parts is equal to the whole. Can this be held in the case of living beings, especially rational, free beings? An answer to this

question depends on what life and rationality are. Reductionism presupposes that life is made up of parts, and hence can be reduced to its component parts. Although we have a good idea about the manifestations of life, the question of what exactly life is seems still to defy any definitive answer.[12] The same can be said about rationality and human freedom.

### Nature vs Nurture

HGP is related to the physical aspect of a human person, which, though absolutely necessary, is seriously inadequate to describe the human person since humans are far more than pure physical or material beings. A human person is not just a collection of atoms and molecules, however sophisticatedly organized, but is very much a product of his/her social, cultural, religious surroundings. Both what is given by way of nature and what is given by nurture are important in shaping a person. Hence HGP can provide only a partial explanation of a human person.

## The Possibility of Long Life

### Long Life through Repair

It is indeed possible to extend one's life by careful and effective repair of defective or damaged parts. However, if a more effective and lasting effect is desired, one will have to resort to nanotechnology. The expectation is that this technology will soon be very much within the capabilities of science. Since this is technology at the molecular level, the assumption is that the conditions at the micro-level are the same as those at the macro-level. But physics tells us that the micro-world of physics is governed by the uncertainty principle, which puts certain specific limits to what is attainable by science. Wouldn't there be some such principle in the world of biology also? If so wouldn't it put some limit to what is attainable in the micro-world of biology?

### Long life through cloning

Cloning plays an important part in the efforts by science to prolong life since it cannot only supply suitable body parts for the replacement of defective parts, but also produce a true replica of a dying person so that he/she "continues to live." However, both these

possibilities involve serious questions, technical as well as moral. The practice of producing clones to supply parts for the human body is a matter of serious controversy since this demeans human dignity, reducing humans to a commercial commodity.

Cloning a dying person involves a number of problems. First of all, a perfect duplicate cannot be formed, not even physically. The process of cloning requires three agents: the donor who supplies the agent to be cloned in the form of a cell nucleus, the denucleated[13] egg which provides the required nourishment to the clone in its early stages, and the surrogate mother who takes care of the clone during pregnancy. A perfect duplicate can be produced only if the denucleation process is 100% complete, but it has been found that it is usually only 99% complete. Hence 1% of the ovum nucleus is present in the clone, thereby bringing in some of the features of the egg donor. This 1% can in no way be overlooked since we know that a difference of 1.6% at the genome level changes a being from a chimpanzee to a human being.[14] Thus even physically a perfect duplicate is impossible.

Even if science were to perfect its techniques and get a perfectly denucleated egg, this in no way guarantees a perfect duplicate since the womb of the surrogate mother provides the environment and nourishment for the clone in its embryonic and fetus stage, and so this surrogate mother will have a role in shaping this cloned being. Once the cloned child is born, the social, cultural factors take over the development of the child in significant ways, thereby foreclosing the possibility of real continuity with the original. All these considerations raise serious questions about the claim that cloning can be a reliable and authentic means for prolonging the life of a dying person.

The moral problems associated with this process are enormous. Since this has been discussed elsewhere, we will not take up this point here.[15]

## Is a Long Life Desirable?

Although at first thought a long life is highly desirable, and an everlasting existence on earth even more attractive, a moment's reflection on the matter can reveal that this tempting prospect is not

all that rosy, particularly so if there is no guarantee about the good quality of life. If every person lives up to a thousand years rather than up to a hundred, as it is today, and if the current rate of increase of population continues, will there be enough material resources in the world to meet the normal needs of all? We also need to keep in mind that as people age more, their needs and the level of care required increase. Will there be enough space for people to live comfortably since there is no way of expanding the size of the earth? Migrating to other planets may be a solution; but so far we have not spotted any inhabitable planet. Will there be enough jobs to keep all employed? Already today taking care of senior citizens has become a frightening responsibility even for the most economically developed countries. If humans cannot be guaranteed of a life with dignity and reasonable comforts, a long life may be more a punishment than a blessing. These problems will be multiplied many times over if physical immortality for humans were to become a reality.

## Trans-homo Sapiens Species

The possibility of our species developing is good tidings for all, and the prospect of humans being collaborators in this noble task is indeed a matter of honour for the human species. But if this onward progressive march should lead to the emergence of a trans-homo sapiens species, the situation could be extremely challenging and even alarming.[16] For one thing, like all the past phases of evolution, this too would be a slow, gradual process – it would not be the case that the existing species disappears abruptly, and a new one appears at once. This means that at a given time, both homo sapiens and trans-homo sapiens would be existing side by side. How would they look at each other? What kind of relationship would there be between the two? How would the expected superiority complex on the one side and the inferiority complex on the other be tackled? Can we deny that this situation would bring back the accursed slavery with a vengeance? One can expect social, economic and ethical unrest in this state of affairs. Chaos and confusion may become the law of the land.

## The Need for a New Ethics

The scenario depicted above may look like pure science fiction, not to be taken seriously. However, the history of science tells us that when it comes to science, today's fiction is often tomorrow's fact; today's dream tomorrow's reality. It is true that the scenario above will not take place within a few years, but it will take place, and we will have to be prepared for it. Some effects of the developments in genetic engineering will hit us in the near future. For instance, eugenic use of genetic engineering knowledge and techniques for enhancing the characteristics of offspring in desired directions is very much on the cards now. This is something only the super-rich can afford under the present conditions. Rich nations can profit from it more than the less rich ones. All these will lead to discriminations within a nation and between nations, with accompanying political and moral problems. As the developments progress, the problems will become more acute and the divide between the haves and the have-nots will widen.

All these considerations point to a situation far beyond the purview of science, far beyond the competence of professional scientists, however gifted and well-intentioned they be. These matters are far too pregnant with grave consequences to be left in the hands of scientists alone. We need to develop a broader perspective and a broader approach. We need to develop new and effective ethical values to respond responsibly and creatively to this challenge, an ethics that will enable us to benefit from the advantages of science without having to suffer from the bad effects of technological developments, or at least enable us to maximize the blessings of science while at the same time minimizing its curses.

I believe that humans can do this. Just as humans have developed such a successful science, they can also help in developing new and revolutionary ethical principles and values. This is the principal challenge and task facing science-religion dialogue today. Both scientists and religious scholars need to join hands in this momentous task because our experience shows that science without values can lead to monstrous minds, and values without science can lead to mindless monsters.

## Notes

1. "The Meaning of Death: Scientific and Religious." Internet.
2. See "The Human Genome Revolution, Society and Religion," *Samanvaya* 3 (2002), pp.74-93.
3. In this case also some recent studies have found a role for the "junk" genes in connection with the complexification and related properties of living beings.
4. Telemerase is an enzyme that protects cells from degeneration.
5. Leonard Hayflick in 1962 discovered that cultured human cells die after undergoing 50 divisions. The death of a human cell after about 50 divisions is known as Hayflick Limit.
6. The basic idea of cloning is quite well known today. The process involves obtaining an egg cell and denucleating it or stripping it of its nucleus. To this denucleated cell the nucleus of the cell to be cloned is inserted. The new cell is introduced into the womb of a surrogate mother where it grows into an exact duplicate of the original donor of the nucleus.
7. Ronald Cole-Turner, "The Cloning Controversy a Decade after Dolly," in *Omega: Indian Journal of Science and Religion*, forthcoming.
8. Ibid.
9. Ibid.
10. Phillip Sloan, "New Human Genetics and Religious Vision," in Job Kozhamthadam (ed.) *Contemporary Science and Religion in Dialogue: Challenges and Opportunities*, Pune, India: ASSR Publications, 2002, p. 130.
11. Ibid., p. 130.
12. In recent times attempts have been made to explain life, the spiritual dimension of humans, etc., in certain sophisticated versions of emergentism, supervenience, etc. However, all these attempts leave many questions unanswered.
13. Denucleated egg means that the nucleus has been removed from the egg.
14. Scientists some years ago found that the genome of a chimp differed from that of a human being only by 1.6%. Today some studies put it at 1%.
15. See my "Cloning of Dolly: Scientific and Ethical Reflections on Cloning," *Vidyajyoti* 62 (1998), pp.110-118.
16. See "The Human Genome Project and Human Destiny," *Omega: Indian Journal of Science and Religion* 1 (2002), pp. 36-57.