

CHAPTER – III

Cloning

Even before cloning had emerged as a tangible actuality achieved by scientists, the human mind, by virtue of its ability to visualize and fantasize had toyed with the idea, fictionalized it and painted a picture of the possible consequences which would occur if cloning became a reality. Therefore, for many of us attitudes and positions were born out of our understanding derived from these sources, which invariably involved around a situation in which untethered and unmonitored application of cloning had been done. A 1999 film "The Matrix" presents the picture of a futuristic world very beautifully. The importance of understanding the implications of such situation is very great because science fiction is the product of brainstorming, in which ideas come out free and spontaneous which may appear improbable at one point of time but may become distinct possibilities at some other. Taking cognizance of such dangers helps man to evolve a suitable framework and system of inbuilt safeguards within which the functioning of various endeavours should be contained.

However, equally important is the fact that an objective, dispassionate view which takes account of merits and usefulness should be taken. Many aspects of this scientific achievement contain potential for the welfare and wellbeing of mankind. The application of genetic cloning for the understanding and control of disease that is, therapeutic cloning is one such aspect. Focussing on the possibility of achieving better understanding at molecular level and thus more effective treatment and control, one find optimistic evidence in the area

of genetic cloning.

Though many Govt. conducted heated debates (in Indian parliament there was a debate about this) on these issues, going through the proceedings one finds that commercial interests of certain influential organisations were predominantly echoed in statements made rather than an evaluation of the intrinsic issue. And considering that a large amount of money is involved and the power of money is unbelievably strong, no one can hold back the tide. The only alternative at our disposal is to evolve ethically viable framework and parameters within which the enterprise should grow, so that value based science triumphs over the rat race for money.

The birth of Dolly

The birth of Dolly, the world famous cloned sheep, has an extraordinary impact on many dimensions of our lives, both intellectual and real. It has fuelled debate on a number of issues: genetic, scientific, political, moral, journalistic, and literary. It has also given rise to a number of myths, not least among which is the myth that Dolly presents a danger to humanity, the human gene-poll, genetic diversity, the ecosystem, the world, as we know it, and the survival of human species.

When Ian Wilmut and his co-workers at the Roslin Institute in Edinburgh announced early in 1997 that a sheep 'Dolly' had been successfully cloned, there was an amazing spontaneous reaction. The reaction of the scientific community was, on the whole, friendly. In contrast, the reaction of the public at large was overwhelmingly negative, primed to some extent by a media weaned on a diet of previous cloning scare stories and pulp fiction. People all around the world felt that something morally problematic was threatening to

happen. Most of the concern centers not on the cloning of sheep, but on the likelihood that sooner or later someone will clone a human being.

When we examine the ethical aspect of cloning we are dealing with two disciplines: Ethics and Biological Science. Ethics is not an exact science, whereas cloning i.e. biological science is. Therefore the former has a tendency to generate more controversies than answers. What is ethical for one may not be ethical for others. Let us try to understand how the ethical issues are being exploited by the society and by the media specially which try to control the masses and the society at large. Media is not free of interests. Controversies improve ratings and generate more profits. Opinion polling and controversies are intertwined. If we eliminate this factor of bias, we would perhaps look at the real issue more objectively. Again, anything that does not make one feel good is unethical, but may not be illegal. This feeling may be based on how one is brought up, socially or otherwise. Unethical matters one time could become ethical later on if we could justify the need or have use of them.

In the following sections our effort will be to look at the current debate, the benefits and concerns about cloning. Cloning offers a useful starting-point for those who need convenient access to information about the many issues involved in genetic engineering. Let us start with the basic question: what is cloning? We need to know this because non-understanding of it gives rise to many confusions.

A history of cloning

Early humans discovered that if they plant seeds produced by the healthiest plants, the next crop will be a strong one. This discovery of better breed of corn was perhaps the first step in manipulating life to

suit human needs. Thousands year later to ease their backbreaking labour, we find the instance of farmers breeding female horses with male asses to produce mules (mules were desirable beasts of burden because of their endurance, surefootedness, intelligence and long lifespan). Much later in 1952 a tiny tadpole makes history as the first cloned animal. Using cells from a tadpole embryo, Robert Briggs and Thomas king create new tadpoles identical to the original donor. Soon after that there was a rapid development one after another. In 1965 cloning goes to box office in the movie classic, THE HUMAN DUPLICATORS. Primitive special effects dominate this hilarious alien-invaders flick. In 1972 cloning steps down to the minute level with the first cloning of a gene. Scientists isolate the gene, then bind it to an organism (in this instance a yeast) that incorporates the gene into its own DNA and multiplies, producing many copies of the desired gene. In 1976 Rudolf Janeisch of the Salk Institute for Biological Studies in La Jolla, California, injects human DNA into newly fertilised mouse eggs to produce mice that are part of human. When the mice reproduce, they pass their human genetic material to their offspring, creating a slew of so-called transgenic mice. Different human disease could be studied by creating mice with the appropriate genetic combination. In 1978 the world for the first time listened the news of first test-tube baby. The world clamours for a glimpse of Baby Louise, the first child conceived through in-vitro fertilization (using the husband's sperm, British doctors fertilise an egg in a petri dish, then implant the embryo in the uterus of the healthy woman). In 1978 David Rorvik's published his In His Image: The Cloning of a Man. In the novel, a man is cloned from skin cells. In 1987 the first mammals, sheep and cows, are cloned from embryonic cells. But animals cloned from embryonic cells contain the genetic material of both parents because the embryos are sexually fertilised. Clones from embryonic cells from the same parents fertilized

at different times are as different as brothers and sisters. In 1993 the episode of Dinosaur cloning appeared in super movie Jurassic Park. A few strands of prehistoric DNA have fossilized, and that is enough for an ambitious park owner to wreck genetic havoc. In 1995 sequencing all of a bacterium's genetic material was accomplished by J. Craig Venter of the Institute for Genomic Research in Rockville. Venter uses chemical analysis to identify all the genes of *Hemophilus influenzae*, the bacterium that causes meningitis and children's ear infection. Scientist hoped to sequence the human genome by 2005 (but completed much ahead of deadline), which would enable scientists to target specific genes for research. In 1996 Dolly is cloned but the world did not know until 1997, when her existence was revealed. Using older techniques as well as some new tricks, Scottish researcher Ian Wilmut clones Dolly from an adult cell.

What is cloning?

Human cloning is the creation of a human being, or a number of human beings, who is/are genetically identical to another. In the current debate, we usually hear cloning referred to in one of two ways: Reproductive cloning and therapeutic cloning. Reproductive cloning refers to the creation of a new person with the same genetic make-up as someone who is alive or has lived. Therapeutic cloning refers to using cloning techniques to initiate the growth of embryos in order to create new organs or cells for medical and research purpose.

Artificial cloning can be carried out by one of two techniques: Embryo splitting and nuclear replacement. Embryo splitting is similar to the natural process which creates identical twins---the embryo's cells are separated at a very early stage of development to create one or more clones. Nuclear replacement is the process that was used to

create 'Dolly', the sheep. It works by taking a cell nucleus from one person (e.g. from a skin cell) and putting it into the egg of another, whose nucleus has already been removed. The egg is then stimulated to divide, for example, by treatment with bursts of electric current, thus starting the growth of an embryo. The egg's nucleus contains all the chromosomes (genetic information) for the cell to start dividing and become a fully developed child in due course. Nuclear replacement technology can be used to create a clone from a person of any age (embryo, foetus or adult) and it can potentially create many more clones than embryo splitting.

Cloning seems to offer new possibilities of medical advances. Some people might want to use cloning to replace a dead baby or child; or indeed have a child if they are infertile. Others may want to replicate themselves for future generations, while yet others may want to create a clone to produce an organ for transplantation without complications of rejecting the organ, i.e. for therapeutic purposes.

Cloning techniques :

Nuclear transfer (a general overview)

First explored by Hans Spemann in the 1920s to conduct genetics research, nuclear transfer is the technique currently used in the cloning of adult animals. A technique known as twinning exists, but can only be used before an organism's cells differentiate. All cloning experiments of adult mammals have used a variation of nuclear transfer.

The Roslin technique

The cloning of Dolly not only sparked a public interest in the

subject, but it also proved that the cloning of adult animals could be accomplished. Previously, it was not known if an adult nucleus was still able to produce a completely new animal. Genetic damage and the simple deactivation of genes in cells were both considered possibly irreversible.

The realisation that this was not the case came after the discovery by Ian Wilmut and Keith Campbell of a method with which to synchronise the cell cycles of the donor cell and the egg cell. Without synchronised cell cycles, the nucleus would not be in the correct state for the embryo to accept it. Somehow the donor cell had to be forced into the Gap Zero, or Go cell stage, or the dormant cell stage.

The Honolulu Technique

In July of 1998, a team of scientists at the University of Hawaii announced that they had produced three generations of genetically identical clone mice.

The technique is accredited to Teruhiko Wakayama and Ryuzo Yanagimachi of the University of Hawaii. Mice had long been held to be one of the most difficult mammals to clone due to the fact that almost immediately after a mouse egg is fertilised, it begins dividing. Sheep were used in the Roslin technique because their eggs wait several hours before dividing, possibly giving the egg time to reprogramme its new nucleus. Even without this luxury, Wakayama and Yanagimachi were able to clone with a much higher success rate (three clones out of every one hundred attempts) than Ian Wilmut (one in 277).

After proving that the technique was viable, Wakayama also made clones of clones and allowed the original clones to give birth

normally to prove that they had full reproductive functions. At the time he released his results, Wakayama had created fifty clones.

This new technique allows for further research into exactly how an egg reprogrammes a nucleus, since the cell functions and genomes of mice are some of the best understood. Mice also reproduce within months, much more rapidly than sheep. This aids in researching long-term results.

How did people react to the news ?

As soon as the news of cloning Dolly broke out almost every organisations and sensitive people reacted to it. On the one hand, there are those that feel that the benefits and advances gained from cloning outweigh any social dilemmas; on the other hand, there are those that feel that cloning is wrong on a fundamental moral level and would produce scientific and social problems. In weighing in on these views, major organisations draw on numerous sources including religious law, party philosophy and scientific concern. Some object to cloning on a purely ethical level, while others favour cloning solely for the scientific advances it will produce. Let us state here some of the stances of some prominent religious, scientific, and ethical groups.

From the Catholic Church John Paul II released a statement condemning the cloning of all life forms. The vatican also issued a statement that only condemned human cloning, but did not address other forms. Martin Robra, executive secretary, the World Council of Churches commented that the council would prefer a moratorium until all ethical questions can be resolved. Marry Seller, from Church of England Board of Social Responsibility, commented: 'The antics of a few cranks and Hitler types' should not impede cloning research. 'Cloning, like all science, must be used responsibly. Cloning humans is

not desirable. But cloning sheep has its uses.'

Islamic scholars took an ambivalent attitude towards this scientific advancement. Abdelmo'ti Bayyumi, a theologian from Al-Azhar university, declared it is forbidden to clone animals under Islamic law. However, some Muslim scholars have testified to the National Bioethics Advisory Committee that they feel cloning might be allowable if it produced ways to counteract infertility.

The chief Rabbi of Israel, Meir Lau, stated that the cloning of any creature is against Jewish law. However, some Jewish believe cloning in order to produce better food and medication would be allowable in Jewish tradition.

Different scientific and economic organisations were by and large in favour of accepting this new-found technology of course with safeguards. Stephen Grebe, Professor of Biology, American University said: "We're going to be facing this issue with humans...With that possibility open, I'm concerned that without safeguards this will become a reality." Randolfe Wicker, founder of Clones Rights United Front, said: "We're fighting for research, and we're defending people's reproductive rights." Steve Dasch, chairman of the Libertarian Party writes: 'Politican should not have veto power over the creation of new life---especially human life...That's why the Libertarian Party supports reproductive freedom of choice --- whether they choose to reproduce using the traditional method, or artificial insemination or invitro fertilisation, or cloning...if cloning research is banned, millions of people could suffer.' On the other side of the table we have Jeremy Rifkin, president, Foundation of Economic Trends. Proposing a world-wide ban on cloning, he says it should carry a penalty 'on par with rape, child abuse, and murder'. Carl Felbaum, president of

Biotechnology Industry Organisation, says: 'One of the prospects should not be, perhaps should never be, the extension of this technique to human beings... Now that it may be possible we would say it should be prohibited if necessary by law'.

Law on cloning

- In Indian Parliament the possibility of cloning was discussed. But it was told by the concerned minister that there was no possibility of cloning in near future on Indian soil. Hence there was no need of bringing a bill for banning cloning.

- In the west in March 1997, the European Parliament voted in a resolution to ban cloning of human beings. However, the resolution carries no legal weight. This policy area remains more obviously a matter for individual member states, with national politicians bringing in legislation on human cloning.

- In December 1997, UNESCO published the Universal Declaration on the Human Genome and Human Rights. Article 11 bans 'practices which are contrary to human dignity, such as reproductive cloning of human beings...'

- In Strasbourg, the Council of Europe, with 40 member states, produced a protocol banning human cloning which has been added to their Convention on Biomedicine and Human rights, and was signed on 12 January 1998 by 19 member states.

The U.K. Government rejecting expert advice blocked any move to clone human embryos for the production of tissue for transplants and a range of other medical treatments. The pro-cloning group accused the government of giving in to media scaremongering.

Some Governments also rejected the recommendation that cloning embryos for the supply of cells and tissue for medicine should be allowed. Scientists claimed that therapeutic cloning would harness the techniques used to clone Dolly, the sheep, to turn a cell from a patient into compatible tissue and cells for transplant. However, Government said that more evidence was needed --- from animal research, for instance --- of the potential benefits to human health.

Despite Governmental legislation of blocking human cloning researchers were confident that despite a hiatus, human tissue will be grown soon. A Government frightened by public resentment of genetically modified foods was hardly likely to push its luck with something that would be presented as approval for human cloning.

Some misconceptions about cloning

Most cloning misconceptions arise from a lack of knowledge. Most people do not understand the basic principles of cloning, and likely to make rash generalisations about whether cloning is natural or not. Other misconceptions focus on the societal problems resulting from cloning. Many of these misconceptions are only valid in a society without regulations or laws of any kind. People forget that along with new technological developments come rules and guidelines to prevent the kind of scenarios here. Each misconception results from a distortion of the truth, which is presented here, with each incorrect belief.

- A clone would not be a normal human.
- Cloning is 'playing god'.
- Cloning is not a natural process.
- A clone will not have a soul.
- A clone will have the same feelings and emotions as its genetic parent.

- An unconscious clone could be produced to supply organs.
- Someone could own a clone.
- Great individuals of the past could be reborn.

As to first point (i.e. a clone would not be a normal human) let us say that whatever the methods of production, a clone would be as 'human' as an identical twin. Both are derived from a single fertilized egg.

About the second point let me make it clear that cloning does not create life, as this stigma implies. Cloning merely produces life from existing life. Cloning can be thought of as an extension of procedures like in-vitro fertilisation.

It is not true that cloning is not a natural process. Cloning utilises elements that already exists in the natural reproduction process. Embryo cloning pulls apart a zygote at the two-cell stage and creates two one-celled organisms. Although some might say that cloning is not intended form of reproduction, the same might be said of in-vitro fertilisation, and the use of fertility drugs.

About the fourth point this seems to imply that the soul is a quantifiable physical element of someone's genetic make-up that can be altered or taken away. In this case, cloning does not present more of a religious problem than identical twins. Despite them being identical, it is agreed that both twins have souls.

It is myth, say experts, a clone will have the same feelings and emotions as its genetic parent. An oft-taken example of this idea is a Hitler clone starting a new Holocaust. While genes and genetic structure can give certain characteristics and possibly basic emotional tendencies, environment and upbringing play a much larger role in

shaping someone's emotions and outlook. A Hitler clone that had been raised somewhere else and had lived in a period of stability and prosperity would not act the same way as a Hitler raised in Germany living amongst post-war devastation and hatred.

The next point despite being morally questionable, producing a clone with no self-awareness requires a deeper knowledge of where the consciousness resides. Consciousness is not a certain trait that can be erased through genetics, and there can be no isolated DNA that determines its existence. Furthermore, just proving that a clone is not self-aware would be difficult. People with debilitating neurological disorders may appear mentally incapacitated but retain full consciousness. However, researchers have theorised the possibility of cloning only certain organs to use as replacements for an individual in dire need of a transplant. Scientists believe that if the cells of an organ have the same genetic make-up as those of the host organism, the organ would be much less likely to be rejected after a transplant.

Although cloning is being considered as a future infertility remedy, and essentially, a clone would be made for the parents, no one could own a clone. Ownership of a clone would be no different than slavery. People that predict a massive working underclass produced from cloning forget that despite the methods of their birth, clones would carry the same rights as a person produced through normal reproduction.

About the final point, all current techniques to clone an adult cell use the method of nuclear transfer, which requires the donor cell to be alive. In this process a live adult cell is fused with an egg cell or its nucleus is extracted and inserted into the egg. At this time, and most likely far into the future, clones of dead organisms cannot be created.

Also, even if such an individual is cloned, the development of the person is largely dependent upon its upbringing and childhood surroundings. Just as a theoretical Hitler clone would most likely not grow up to start a new Holocaust, an Einstein clone would probably not become a world renowned physicist.

Benefits of cloning

There are many ways in which human cloning is expected to benefit mankind. Here is a list which is far from complete.

- It may someday be possible to reverse the ageing process because of what we learn from cloning.
- Scientists believe that they may be able to treat heart-attack victims by cloning their healthy heart cells and injecting them into the areas of the heart that have been damaged. Heart disease is the number one killer in many countries.
- Embryonic stem cells can be grown to produce organs or tissues to repair or replace damaged ones. Skin for burn victims, brain cells for the brain damaged, hearts, lungs, livers, and kidneys could be produced. By combining this technology with human cloning technology it may be possible to produce needed tissue for suffering people that will be free of rejection by their immune systems. Many diseases will become curable if human cloning and its technology are not banned.
- With cloning, infertile couples could have children. Despite getting a fair amount of publicity in the news current treatments for infertility, in terms of percentage, are not very successful. Couples go through physically and emotionally painful procedures for a small

chance of having children. Many couples run out of time and money without successfully having children. Human cloning could make it possible for many more infertile couples to have children than ever before.

- Because of human cloning and its technology the days of silicone breast implants and other cosmetic procedures that may cause immune disease should soon be over. With the new technology, instead of using materials foreign to the body for such procedures, doctors will be able to manufacture bone, fat, connective tissue, or cartilage that matches the patient's tissues exactly. Anyone will be able to have their appearance altered to their satisfaction without the leaking of silicon gel into their bodies or the other problems that occur with present-day plastic surgery. Victims of terrible accidents that deform the face should now be able to have their features repaired with new, safer, technology.

- The average person carries eight defective genes inside them. These defective genes allow people to become sick when they would otherwise remain healthy. With human cloning and its technology it may be possible to ensure that we no longer suffer because of our defective genes.

- We may learn how to switch cells on and off through cloning and thus be able to cure cancer. Scientists still do not know exactly how cells differentiate into specific kinds of tissue, nor do they understand why cancerous cells lose their differentiation. Cloning, at long last, may be the key to understanding differentiation and cancer.

- Cloning technology can be used to test for and perhaps cure genetic diseases.

The above list only scratches the surface of what human cloning technology can do for mankind. The suffering that can be relieved is staggering. This new technology heralds a new era of unparalleled advancement in medicine if people will release their fears and let the benefits begin. Why should another child die from leukemia when, if the technology is allowed, we should be able to cure it in a few years' time?

Frequently asked questions

Until the birth of Dolly, it was believed that the ability to clone an adult human was either impossible or possible only in the distant future. However, human embryos have been twinned in the past. These were true clones and they were not viable, however, for they did not survive.

The emergence of new technologies creates a new set of cultural events and their consequences with which human cultures must come to terms. Humans must define a status and a role of any new technology. This is a process of adaptation and acculturation. In a sense, this is a process whereby humans try to decide what a new technology 'means' to them. Questions frequently asked during this process of acculturation and adaptation include:

- What are the needs and goals this technology might serve? Is this technology the only means for addressing these goals and needs?
- What members of which communities have these goals and needs?
- Of these groups in need, who will have access to the

technology and its products; for example, will it be only special individuals or classes of people?

- Who will be benefited, and who will be harmed, indirectly as well as directly, by implementation of this new technology?
- How reliable, how safe, and how well can this new technology be controlled?
- What is the best case, and what is the worst case, scenario if this technology were encouraged, or if it were impeded, in its development and implementation?
- Is this new technology to be defined as 'necessary' or 'essential', or 'innocuous' or 'superfluous' or 'good' or 'bad'?
- Is this technology, or are its consequences, to be deemed ethical, moral, immoral?
- Should this technology be considered be considered a form of 'property', to be held by individuals or publicly held and administered? And if so, by whom?

Should Humans be cloned?

God cloned Eve as there was a necessity for Him to create a woman and a wife for Adam. If it is right for God, how could it be wrong for humans to do the same thing? But in reality, it may be unethical for humans to clone anything, including humans, when he has been provided the perfect mechanism for propagation, like having babies with love and passion. Cloning of an adult to an adult is beyond the knowledge of humans as of this day. From this point alone, cloning to have babies may not be all that ethical unless there are other reasons

to justify this method. Anything that cannot be justified is unethical. The cloning science is exact, whereas the ethics part of it is subjective, and subjective issues are dictated by people who have resources to implement their wills over the society. All the ethical conduct that we see around us today may not be at all that ethical if the rationality and truthfulness had prevailed without hindrance.

A Time Magazine poll (March 10, 1997) reported that 74% of those asked believe it is against God's will to clone human beings. President Clinton has banned federal funds from being used for human cloning research, stating that any discovery that touches upon human creation is not simply a matter of scientific inquiry, it is a matter of morality and spirituality as well. Each human life is unique, born of a miracle that reaches beyond laboratory science.

But others argue in favour of continuing human cloning research, of continuing to clone human embryos and perhaps cloning adult humans in the future. Some arguments in favour of human cloning might include the fact that cloned human embryos would make research into genetics and genetically related diseases, and their treatments or preventions, much easier and cheaper. Cloning embryos could also facilitate the process of in-vitro fertilisation, since the collection and replacement of ova is often painful and traumatic, and can be unsuccessful.

We have already mentioned that embryo cloning is seen as a potential treatment for infertility when in-vitro fertilisation is not available, such as when parents are infertile, or when one or both parents harbours a genome coding for certain undesirable traits or diseases, or if the parents are homosexual couples. Cloned embryonic tissues might be used for the replacement of lost or diseased tissues.

Adult cloning might appeal to those who desire children/adults who are genetically identical to themselves, or genetically identical to someone who is a non family member. Cloning could provide a genetically identical replacement for a lost loved one.

The belief here is that cloning can be justified as an expression of reproductive freedom of choice, a choice that should not be limited by legislation. However, it is important to remember that a genetic clone, although sharing an identical genome with the donor, will not be physically and behaviourally identical to the donor. Their physical and behavioural characteristics will differ in many important and significant ways.

Perhaps the most urgent ethical, legal and social issues about cloning arise in the context and process that may lead to the birth of a first human clone. This is so because, as has been pointed out by scholars, early human experiments are likely to result in a number of clinical failures and lead to miscarriage, the necessity of dozens or even hundred of abortions, or births of massively deformed offspring. Recent study of mammalian cloning also suggests that a number of defects often created in the reprogramming of the egg do not manifest themselves until later in the life of the resulting clone, so that mature clones have often undergone spectacular, unforeseen deaths.

The dangers for early prospective clones are controversial and difficult to manage because

- In part, one is attempting to protect a future potential person against harms that might be inflicted by their very existence, and

- In part because societies around the world have indicated that they believe that the early cloning experiments will breach a natural barrier that is moral in character, taking humans into a realm of self-engineering that vastly exceeds any prior experiments with new reproductive technology.

Human cloning from religious perspectives

The most commonly cited ethical and moral arguments against human cloning seem to originate from religious perspective. These religious arguments can even be made by politicians and scientists with religious sympathies. Many religious philosophies teach, for example, that human life is unique and special and should be created, determined and controlled only by their deities. Many religions believe in the existence of, and in the individuality of, a human soul. Many Christians, for example, will be concerned about whether it will be possible to clone the human soul, along with the human. If it is possible to clone the soul, what will this mean? In contrast, if a person is cloned, but not their soul, what will this mean? Can a clone without a soul be destroyed and not offend our moral and religious beliefs? Cloning will be divined by many as humans assuming the powers, the providence, and the jurisdiction of their deities or other spiritual powers of their supernatural universe.

Not all religious leaders, of course, feel the same. In contrast to the opinions of their peers, some Jewish and Muslim religious leaders testified before the National Bioethics Advisory Commission that they feel that embryo and cloning research might provide discoveries that would lead to an appropriate way to counter infertility.

Is Human cloning scientifically ethical?

Currently, human cloning is illegal in many countries. In the U.S.A, e.g., federal, but not private, funds are prohibited from being used to create human embryos or do research on human embryos if they will be harmed or destroyed. In addition, the then President Clinton has imposed a moratorium on human cloning research. As decision makers in various countries debate whether or not to support research on human embryos and human cloning many ethical and legal questions arise.

For example, how will the state ban on human cloning research and the ban on certain types of human embryo research affect other, related fields of research that are deemed important? Human embryo and human cloning research can be used to conduct research and development of contraceptives, studies aimed at understanding the causes of human infertility and its solutions, research involving genetic testing, genetic engineering, disease diagnosis, prevention and treatment, and in testing various medicines and medical procedures. In contrast, if the government funds this type of research, then it will have some important control over the nature of the research. If the government decides to continue to not fund human embryo and cloning research, then the government will not have one important avenue for controlling, to some degree, the nature of the research. If the government refuses to support this research, would a funding vacuum be left that market forces will quickly fill? If the private sector is left to fund research and development, then will this research be driven by entrepreneurial profit motives? What effects will entrepreneurial forces have on the nature of such research and development?

Another related question is: Does the governmental ban violate academic freedom, and the right to think, inquire, and do research? When or should the research involving human embryos and cloning be defined as 'academic research and inquiry'? If this research is defined as academic, should the scientific research on human embryos and cloning be protected under the guarantees of 'freedom of speech'? There are limits to the kinds of speech that is protected under the above freedom. For example, it does not protect speech that is deemed to be obscene, or speech deemed threatening to national security. Some citizens believe that research into and/or trying to clone humans is wrong, while others disagree. When considering whether or not cloning research, or other kinds of academic research, inquiry, and scientific communication are to be protected, and to what degree, by the above freedom, the government decision makers have to decide how best to balance protecting the freedoms of speech and inquiry of the scientific community — and benefits their research might produce — against the need to protect other citizens from any dangers this kind of freedom of speech, and its products, might also produce.

In the absence of governmental controls, can/or should the scientific community regulate itself, through peer review, when it comes to human embryo and cloning research? Should society entrust the scientific community to regulate themselves? Would this allow and encourage practices leading to conflicts of interest? Should some other private organisation, independent of the scientific community or the federal government, have this responsibility?

Finally, and perhaps more importantly, if there is a market for human embryo and cloning research, and the products of their research, can any type of legislation, at any level, aimed at restricting them be effectively enforced?

A democracy is designed to facilitate a balance between competing interests, to achieve the maximum benefit for the maximum number of its citizens. The introduction of new technology challenges a democratic society to decide who gets what, when, where, and how much. The advent of cloning via nuclear transfer technology presents the inevitability of new and important social changes, and new issues concerning this power, and who controls it, are at hand.

In some countries it is possible to both cloning processes and genetically altered, living creatures. Anyway, patenting the process of cloning is possible. Questions concerning the ownership and control of cloned plants and animals, who may not have been genetically altered, have not been answered.

Another important questions is: What do genetic engineering, and the cloning of human beings, mean for sociological and legal definitions of, and concepts concerning, the notions of 'individual', 'human', and 'citizenship'? These will be some of the most difficult and interesting questions that need to be decided. Would a cloned human be an individual? Would it really be a human, with a soul? And what if this clone were then cloned again, and again? What would their status and roles be? Would a non-human primate, such as chimpanzee, who carried one or more human genes via transgenic technology, be defined as still a chimp, a human, a sub-human, or something else? If we choose to define it as a human, would we then have to give it rights of citizenship? And if humans were to carry non-human, transgenic genes, would that alter our definitions and treatments of them?

Another important issue is eugenics. Can we, and should we, use the biotechnologies of genetic manipulation and cloning to improve

the human condition? What are some of the perceived risks and benefits of eugenics? Other questions and issues include a revitalisation of the 'nature/nurture' debate. Will cloned humans really look exactly alike? Will they have identical personalities? How will clones impact the future of twin studies meant to ferret out the different impacts of genes vs. the environment? What will human clones be able to contribute to the perspectives of sociobiology?

Hilary Putnam argues that cloning humans violates human dignity even when the purpose is not as blatantly instrumental as producing an organ donor. For him, the issue poses an extremely grave problem. The problem may be for two reasons: (1) the scenario that we learn how to clone people, and (2) the technology becomes widely employed, not just by infertile couples, but by ordinary fertile people who simply wish to have a child just like so-and-so. Putnam is of the view that there are many grounds, including some obvious grounds, for being worried about the possible misuse of cloning technology. For Putnam, before deciding the fate of technology what we need first and foremost is a moral image of the world. Write Ruth Anna Putnam, without a moral image any moral philosophy is incomplete. In his book *The Many Faces of Realism* he defines moral image not as a declaration that this or that is a virtue or a right, it is rather a picture of how our virtues and ideals hang together with one another, and what they have to do with the position we are in. We can get a richer appreciation of the Kantian project in ethics if we see the detailed principles that Kant argued for as flowing from such a moral image (an image of human equality). Unlike Kant, Putnam favours a plurality of moral images. In his plurality of images Putnam conceives some moral images of the family, moral images which turn out to influence how we think not just about the family but about communal

life in general. We do use images derived from family life in structuring our whole way of looking at society and our whole way of seeing our moral responsibilities to one another. Let us now turn to Putnum's conception of an image of what an ideal family be, and what bearing does that have on whether we do or don't view the "cloning scenario" with horror?¹

If the technology of cloning people becomes widely employed, then in the Brave New World we can imagine 'designer children' like 'designer clothes'. 'what horrifies us about this scenario is that, in it, one's children are viewed simply as objects, as if they were commodities like a television set or a new carpet.' Here the Kantian maxim against treating another person only as a means is clearly violated. Richard Lewontin in an article argues that it is hypocritical to worry about this as long as we allow capitalist production relations to exist.² For Lewontin, the very words 'employment' and 'employee' are descriptions of an objectified relationship in which human beings are 'things to be valued according to externally imposed standards'. Putnum argues that Lewontin did not understand the full implication of Kantian maxim. Even when someone is one's employee, there is a difference between treating that someone as a mere thing and recognizing his or her humanity. That is why there are criteria of civilized behaviour with respect to employs but not with respect to screwdrivers.

For Putnum, first of all, if our image is to be a moral image at all, it should conform to the Kantian maxim. In an ideal family, the members regard one another as 'ends in their own rights', as human

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1. Putnam, H., See his article 'Cloning People' available in *The Genetic Revolution and Human Rights* ed. By Justine Burley, Oxford University Press, 1999.
 2. Richard Lewontin, Confusion about Cloning, *New York Review of Books*, 23 Oct, 1997, pp. 18-23.

beings whose projects and whose happiness are important in themselves, and not simply as they conduce to the satisfaction of the parents' (or anyone else's) goals. Moreover it should be inspired by the Kantian moral image, the image, which assigns inestimable value to our capacity to think for ourselves in moral matters. Hegel also in his *The Philosophy of Right* speaks in the same vein and says that the task of good parents is precisely to prepare children for autonomy. The good parent, in this image, looks forward to having children who will live independently of the parents, not just in a physical or an economic sense, but in the sense of thinking for themselves, even if that means that they will inevitably disagree with the parent on some matters, and may disagree on matters that both parents and child regard as important. If this view is accepted and incorporated into one's moral image of the family, then we are showing our willingness to accept the value of diversity. Our moral image of the family should reflect our tolerant and pluralistic values, not our narcissistic and xenophobic ones. And that means that we should welcome rather than deplore the fact that our children are not us and not designed by us, but radically other.

Putnum's reasons for recommending an image of the family which rejects the whole idea of trying to pre-design one's offspring, by cloning or otherwise, are not consequentialist ones. What he has been claiming is that the unpredictability and diversity of our progeny is an intrinsic value and that a moral image of the family that reflects it coheres with the moral images of society that underlay our democratic aspirations. Indiscriminate use of cloning technology may thwart this unpredictability and diversity.

Many co-workers at Roslin Institute opine that if the present research is allowed to continue, it will be of enormous benefit to human

beings. However they also think that human cloning should not be attempted. Alan Cloman, a co-worker at Roslin, for example, argues that reproductive cloning is unethical for two main reasons.

It is essential to stress that from over 430 attempted fusions at the Roslin, 277 reconstructed embryos were made. Of these, only 29 survived to the stage that they could be returned to 13 foster mothers and only one survived to term. In other experiments, some of the lost fetuses were abnormal (some severely so) and were aborted. In addition, fetal abnormality did not always become manifest before an advanced stage of development. Thus, as things stand now in animal models, the technique of nuclear has a low success rate. What implications does this have for human cloning? We have grounds to suppose that attempting cloning in humans would be dangerous on numerous counts. Think of the waste of human material. How many embryos would have to be discarded or would be lost? Think of the suffering, both physical and psychological and psychological, of the biological parents and/or surrogate mother. How many surrogate would be needed? How many times would fertilized eggs have to be implanted into a woman's womb before one implantation was successful? How many fetuses might be miscarried or aborted? Think of any cloned child who was seriously deformed as a product of the cloning procedure.

Advocates of human cloning will say that all the uncertainties could eventually be dispelled by first perfecting the technique in animal models. But there are too many differences in the reproductive physiology and embryology between mammalian species, including humans. We simply could never be confident that high success rates in one species, if achieved, could be replicated in humans without a lot of

human experimentation. Apart from the technical challenges implicit in the extension of cloning to humans, there are more subtle concerns.

There is evidence to suggest that as we get older, the building-blocks of our genes (DNA) gradually accumulates mutations and suffers other changes which account for the fact that we are increasingly liable to develop cancer as we get older, and might also explain how our cells are affected by ageing. Thus a human cloned from an adult cell, as was Dolly, might have a higher risk of cancer or experience premature ageing. We already know that Dolly is suffering from arthritis. Neither doctors nor society should condone a practice which carries the high risks.

It might be objected here that all new medical advances are potentially unsafe, and no progress would be made if safety were the sole consideration. However, risk-to-benefit ratios must always be considered before new treatments are sanctioned. The application of such ratios to new reproductive treatments are particularly problematic given that we must consider risks to the egg donor, the womb donor, and the unborn child. Even if the egg donor and surrogate gave their informed consent, it remains the case that creating a new life by nuclear substitution would be likely to result in the conception of a fetus that suffered abnormality caused by the actual procedure of transferring genetic material from adult cell to gamete, or that the technique would cause a person to suffer a genetically related disorder later in life. Such occurrences would be unfortunate because they could have been avoided.

There may be scope, however, to apply cloning technology in human in a way that would avoid some of the aforesaid experimental uncertainties altogether, and also limit others. Here I have in mind the

case of a prospective mother who has a genetic disease, which is not attributable to the main body of the genes found in the nucleus, but to genes elsewhere in the cell (the mitochondria). With all existing methods of conception, both natural and assisted, all the children of such women would inherit the disease-causing genes. It has been suggested that women who possess defective mitochondria could conceive normally and then a cell from the doomed embryo could be fused to the unfertilized egg supplied by a 'healthy' human egg donor. If successful, this would result in a child free from the disease which has unique genetic blueprint and one made up from equal contributions from the original couple (apart from the offending non-nuclear genes). Even in this sort of case the procedural risk greatly outweighs the benefit. While the circumscribed use of cloning technology just outlined would be less prone to experimental uncertainties, the cell surgery involved would carry risks which could not be justified quantitatively by the benefit. It can therefore be concluded human reproductive cloning, in all its guises, is unethical. A child so manufactured would be a twenty-first-century circus act. Nuclear transfer in humans is patently unsafe and inefficient; the risks greatly outweigh any marginal benefit. As Wilmut comments the potential for non-human cloning work to provide helpful solutions to many problems from which human suffer is vast.

Although we do not yet understand the precise mechanisms behind changes (malformation and risks) during development one day we will learn either to manage them or eliminate them. Ian Wilmut predicts that it will be possible sometime in the near future to master this technique (i.e. to eliminate malformation, etc.), marshal its widespread use, and better understand the implications of the complications involved for human well-being. If we succeed in

perfecting nuclear transfer technology, there are three main ways in which it could be of immense value to us: (making copies of the same animal; making precise changes in DNA; and making cells to order.

Why should we want to make copies of the same animal? First, duplicating animals is very helpful for drug trials. Second, if genetic replicas of farm animals are made, both animal health and agricultural output could be much enhanced. Of course, the technology might be used to copy humans. For the most part this is a patently unattractive possibility (Wilmut). At present, with the likelihood of abortions and infant deaths, it is surely obscene to even consider applying these techniques in human for any reason. In addition to the question of safety there are ethical concerns over potential uses of nuclear transfer to copy existing people. Usually three reasons are put forward for wanting to clone a human: to bring back a lost relative, selective breeding, and to treat infertility.

If we could bring back our lost relative by cloning most of us would do that. We would have the magic wand and summon the child back. But, in fact, what would happen were we to make a copy of someone is that we would make a new, different individual who might very well grow in a different way and become a different sort of person. Our personality is apparently determined about half by our genes and half by what happens to us.

The use of cloning for selective breeding also shocks many. Why someone should attempt it for this purpose is puzzling. Great emphasis is placed on many places on reproductive choice. But surely this freedom must be accompanied by responsibility. Our gravest concern is for the child. Ian Wilmut writes:” Making a copy is not

treating the child in the way that he or she deserves, not treating the child as an individual.”

Using cloning to treat infertility raises first and foremost in many mind concern about family relationships. Could a parent have an effective, healthy relationship with someone who is a copy of them? And, importantly, could the child have a good relationship with his parents. Although it is eminently possible for one’s attitude towards an adopted child to be the same as it is to one’s own offspring, it is strongly doubted that the same parity of attitude could be achieved in a family in which there was a genetic replica of one of the parents.

But there is one way nuclear transfer technology might be used in procreation that many find attractive. This is its use to replace the mitochondrial DNA in an egg. Mitochondria are the small body in each of our cells which supply our energy. They contain DNA, which is subject to error (mutation) leading to diseases in just the same way that chromosomal mutation may cause disease. However, in the case of mitochondria we inherit those only from our mothers. A women suffering from mitochondrial disease knows that her children will inherit the same condition. In principle, there is no reason why the embryo nucleus could not be removed from the defective egg and be placed in a recipient egg cell, itself enucleated. The recipient egg would be provided by a woman known not to have similar damage to her mitochondria, with her full informed consent. The resulting child would be exactly as it would have developed, except that it would not suffer the disease associated with mitochondria. Done thoughtfully, this method of nuclear transfer could provide a way to treat currently untreatable mitochondrially carried diseases.

It may well be possible one day to use the technique of nuclear transfer to prevent known genetic diseases by correcting the

defect in genes. Precise changes in DNA might also enable us to create resistance to malaria (a big killer in the developing world), prevent baldness, or enhance athleticism. The idea of correcting for overt disease in this way involves pragmatic judgements about how much we really know about genes. Though we do not know enough at present, but it is likely that within the lifetimes of the younger members of our society germ-line gene therapy will be used in humans.

One of the abiding SciFi nightmares has been the idea that we could one day replicate human beings asexually, just by copying material from human cells. This was one of the most chilling features of Huxle's *Brave New World*. More measured scientific assessments have generally regarded this as something pretty remote.

Two aspects of the Roslin discovery have set the world of biotechnology alight. One is the fact that a somatic tissue from an adult has been used to produce a live animal. This has rewritten one of the laws of biology. Up to now it had been assumed that once animal cells go through the mysterious process of differentiation, and become a particular type of cell, they cannot go back to being undifferentiated. Now Dr Wilmut's work has caused a set of cells to forget what they are and start all over again, as if they were undifferentiated. The second is that you can clone a large mammal from the cells of an adult of the species. It is this second aspect that has caught the public imagination, because it has dramatically brought forward the question of whether it could be possible to realise the SciFi dreams of cloned humans.

Faced with such a fertile prospect, the human imagination runs riot, and the media have come up with some very bizarre ideas. One article claimed that we might clone humans to select out genetic defects or select for desirable traits. This would be impossible just by cloning. It might in theory be done by germline gene therapy, but that is

quite another, and highly controversial, story. The announcements that nuclear transfer cloning is possible not only in sheep but in cattle and mice suggests that the technique could be quite general in mammals, and thus potentially more likely in humans than when it had been done only on a single sheep.

Scientifically, this would be a big and highly dangerous leap to go from cloning a sheep to cloning humans, and it is premature to discuss this as if it were inevitably going to happen. But this discovery means that we have at least got to ask the question, 'What if?'

Why cloning humans is ethically unacceptable ?

Dr Wilmut, the scientist involved, and his colleagues at Roslin have made it quite clear that they think that to clone humans would be unethical. The Human Fertilisation and Embryology Authority agrees with the general public impression that to clone human beings would be ethically unacceptable as a matter of principle. It is generally agreed that on principle, to replicate any human technologically is something which goes against the basic dignity of the uniqueness of each human being in God's sight. Christians would see this as a violation of the uniqueness of a human life, which God has given to each of us and to no one else. In what sense do we mean this?

Some say that the existence of 'identical' twins means that we should have no ethical difficulty over cloning, or that to object to cloning implies that twins are abnormal. This argument does not hold. Biologically, identical human twins are not the norm, but the unusual manner of their creation does not make them any less human. We recognise that each is a uniquely valuable individual. There are two fundamental differences between cloning and twinning, however. Twinning is a random, unpredictable event, involving the duplicating of

a genetic composition which has never existed before and which at that point is unknown. Cloning would choose the genetic composition of some existing person and make another individual with the same genes. It is an intentional, controlled action to produce a specific known end. In terms of ethics, choosing to clone from a known individual, and the unpredictable creation in the womb of twins of unknown genetic nature belong to categories as different as accidental death is to murder. The mere existence of 'identical' twins cannot be cited to justify the practice of cloning.

It is not the genetic identity that is the crucial point but the human act of control, and it is this element of control which provides the fundamental ethical case against human cloning. The biblical picture of humanity implies that we are far more than just our genes, or even our genes plus environmental influences, there is also our spiritual dimension, made in God's image, constituting a holistic notion of being, in which the relational element is as important as the individual. To be a person is to be in relationship. Hence it is vital that the relational implications of technology are considered alongside the ontological. It is against this picture that most Christians would see it as ethically unacceptable to clone human beings as a matter of principle. In so far as genes are a fundamental part of our make-up, to choose to replicate the genetic part of human make-up technologically is a violation of a vital aspect of the basic dignity and uniqueness of each human. By definition, to clone is to exercise unprecedented control over the genetic dimension of another individual. This is quite different from the control parents exert in bringing up their children. Whatever the parents do or do not do, it is inevitable that they have a profound effect on their children. No one exerts the level of control involved in pre-selecting a child's entire genetic make-up except by a very deliberate act. Moreover, a child can reject any aspect of its upbringing,

but it could never reject the genes that were chosen for it. Such control by one human over another is incompatible with the ethical notion of human freedom, in the sense that each individual's genetic identity should be inherently unpredictable and unplanned.

Cloning raises a number of concerns arising from its consequences, of which instrumentality and risk are of especial importance. To replicate any human being technologically is a fundamentally instrumental act towards two unique individuals—the one from whom the clone is taken and the clone itself. In nearly all the speculative ideas for cloning a human would use the clone as a means towards someone else's end. They would be created as clones for the primary benefit not of the individuals themselves but of some third party. This would be the case for cloning a dying child or parent to help those bereaved cope with the loss, or cloning an infant with a predisposition to leukaemia, as a source of bone marrow which would suffer less tissue rejection problems. These violate a basic ethical principle, that of creating another human being other than primarily for their own sake. There is an important distinction in Christian theology, which admits an instrumental role for animals, to a limited degree, but prohibits it in humans. To clone a child with leukaemia to provide compatible bone marrow would treat the cloned sibling to that extent as means to an end, for the benefit of a third party, rather than for their own sake, and without their consent. Dorothy Werth cited the controversial US case where this was done through normal reproduction. Again, it is rightly said that we have mixed motives for why we want children, but that does not justify treating a child as a means to an end.
