

Cloning, Stem Cells and Ethics

At the end of the millennium several key strands of human endeavour, experience and thought have set the stage for consideration of the prospect of human cloning. The key sciences are embryology and genetics, and the key influences are sociological and moral.

The science of embryology has advanced rapidly, initially in animals and then humans, to the point where highly technical methods in reproductive medicine now exist in what has become a flourishing human infertility industry. Also within the field, and slowly brewing for many years, were animal experiments in cloning, defined simply at first as replication or copying of an organism.

With the arrival of Dolly the sheep, came the first full-blown cloning of an adult mammal, in which the nucleus of an adult cell was transferred to an empty egg cell, jolted with an electric shock to initiate embryonic development, and subsequently implanted in another ewe, to eventually be born as Dolly. The remarkable message of Dolly is that advanced, or differentiated cells, that is cells already matured into nerve, muscle, gland or whatever, in which the genes directing development were long ago turned off, can be made to behave as if they were the earliest embryonic cells just beginning the process of embryonic development. In fact by placing the nucleus of these six-year-old cells into an egg cell, the egg behaves as if fertilised.

In parallel, genetics was coming of age. Its crowning achievement, timed so perfectly as the scientific preamble to the new millennium, was the first draft of the human genome, recently announced as God's handbook, the secret recipe for how to make a human being. And with the revelations, comes a new era of genetic screening and testing, ushering in a new range of almost impossible scenarios for painful decision-making. But screening and testing pale somewhat before another power inherent in this new knowledge. For the opportunity now before us is to engineer changes to this book of life. For several decades the groundwork for genetic manipulation has been laid, as plant and animal genes have been subjected to cutting, splicing, mixing and other manoeuvres. A discussion of human cloning cannot ignore these developments, especially since cloning may provide a particular opportunity for such manipulation.

But there are other developments, not scientific or particularly technological, which make for a climate conducive for even the consideration of human cloning. Our age is unashamed in its extreme individualism. Personal liberty and autonomy have become icons of the age, translated into the mantra of free choice in an increasing assortment of moral arenas ranging from abortion and euthanasia, to prostitution and substance abuse. It is not surprising that in discussions of human cloning, choice rates above other ethical considerations. Add to this the suspension of absolutes and a societal inclination towards a utilitarian way of thinking in matters moral, and the sky's the limit.

Another ingredient in this potent brew is a strongly consumerist mentality, of western civilisations in particular, which has overflowed into a way of viewing human life as a product. This commodification of life expresses itself in diverse ways ranging from the patenting of human genes to the sale of human eggs, so tackily conveyed by 'Ron's Angels', Ron being the entrepreneur responsible for putting up for auction the eggs of attractive, healthy and athletic women.

Exemplified and re-emergent in 'Ron's Angels' is a much older and more fundamental human drive, insidiously opportunistic and ready to adopt novel means for expression. This eugenic drive, that is to improve the human race, has a long and at times particularly ugly history, but for some, recent technological advance has brought with it a new avenue for a more clinical and sanitary eugenics. In the words of Robert Sinsheimer:

The old dreams of the cultural perfection of man were always sharply constrained by his inherent inherited imperfections and limitations ... To foster his better traits and to curb his worst by cultural means alone has always been, while clearly not impossible, in many instances most difficult ... We now glimpse another route – the chance to ease the internal strains and to heal the internal flaws directly, to carry on and consciously perfect far beyond our present vision this remarkable product of two billion years of evolution.

The other route glimpsed by Sinsheimer is the brave new hope offered by modern technological advances, and genetics in particular. And naturally, the definition of perfection, defined in one particular way by Ron of 'Ron's Angels', will always be coupled to the notion of what it means at the core to be human and hence to the particular human qualities deemed most desirable. Disturbingly, society's infatuation with the body beautiful is a clear statement that health, beauty (narrowly defined) and perfect bodily form are to be prized above the less visual virtues of generosity, wisdom, love, self-sacrifice, courage, determination, and so on.

So the climate in which human cloning has technically become possible is framed so that there appear to be limited constraints on its implementation. On this point, I hope I am wrong.

What is cloning? Cloning has several meanings, which need to be articulated. First, strands of DNA can be copied, and this has been carried out for some time. Specific genes have been identified and sequenced before being cloned either for research purposes or to be used in the production of important proteins such as insulin for diabetics, or clotting factors absent in haemophilia.

Second, whole cells can be cloned so that a single cell is simply multiplied in number. Large numbers of identical cells produced in this manner can also be used in research or for the amplification of rare cells in the treatment of certain cancers.

Third, the early embryo, at the two, four or eight-cell stage, can be divided and the individual cells each allowed to develop into separate individuals. This manoeuvre, termed embryo splitting, will produce genetically identical individuals. Furthermore, the removal of one cell from the early embryo allows for limited genetic testing, thus making possible preimplantation genetic diagnosis whereby a decision can be made about whether to implant or discard the embryo being tested depending upon its genetic make-up.

Fourth, cloning by nuclear transfer, where a nucleus containing the genetic material of an individual is transferred into an enucleated egg cell. This final method of cloning was used to produce Dolly from a mature udder cell; however, the nucleus can come from any source, and indeed the technique works better if younger, say embryonic cells are used.

These distinctions are important, particularly when it comes to framing laws. In South Australia for example, cloning is defined as embryo splitting and is prohibited. In addition, transfer of any nucleus into a cell of an *embryo* is prohibited. However, this means that cloning by nuclear transfer into an empty egg cell is not prohibited, leaving open a loophole for Dolly-like cloning. Conversely, blanket legislation prohibiting all forms of cloning would disallow valuable research and clinical methods in the cloning of DNA strands or cells in culture.

The public perception of cloning is strongly influenced by popular conceptions as portrayed in novels, film and other media, and invariably this cloning is reproductive cloning in which humans or other species are cloned, brought to birth and continue development. In many early books and films, clones were viewed as zombies, inferior, robots, stupid, unfeeling, poor copies, evil, soul-less, or unable to exist apart from their fellow clones. To make a good story, extreme and frightening examples were often used. More recently, in films such as *The Boys from Brazil* (in which Hitler clones were generated), or *Multiplicity*, in which Michael Keaton is replicated fourfold, cloning implies quite simply the copying of another human being, usually with disastrous results.

This image of duplication is partly in error, and those who wish to argue against reproductive cloning on the grounds that it involves copying another human being should concentrate their efforts elsewhere, as there are ample alternative reasons for resisting it. It is erroneous because it assumes that the genes are all that makes the person, so that making a genetic replica replicates the person. However, when a human embryo naturally splits and the result is identical twins (which on one definition of cloning, that is embryo splitting, means that identical twins are clones) we know that such twins are different individual human beings, nevertheless sharing a common genome. One is not a copy of the other. A human being cannot be copied. Despite sharing the same genetic material, from the moment of embryo splitting, identical twins follow their own course of development and their interaction with the environment means that that development is unique. While their physical similarities can be eerie at times, we know that the sum of the person is much more than the sum of their genes. The trap of genetic reductionism or genetic determinism is easy to fall into in a climate where there seems to be a gene touted for just about everything, including quite complex behaviours.

But the idea of duplication is only partly in error, because genetic make-up *is* important, and creating a clone of myself would mean that I would be face to face from the birth of that clone with an individual looking just like me at any given age, with my physical strengths and weaknesses, my prospects of genetically related diseases, and perhaps even my predisposition towards certain behavioural characteristics. Unlike twins, who develop alongside one another, I would have a power over my clone by virtue of 42 years of experience about myself. It would probably be the perfect opportunity for me to use my knowledge of my own life to direct the life of my clone. This is a power that twins clearly do not have over one another.

Genetic identity *is* highly significant. In the words of Leon Kass,

... one is short-changing the truth by emphasising the additional importance of environment, rearing and social setting; genotype obviously matters plenty. That, after all, is the only reason to clone, whether human beings or sheep.

Reproductive cloning appeals to some because of its enticing intimations of immortality. In the words of Charles Krauthammer:

Cloning is the technology of narcissism, and nothing satisfies narcissism like immortality.

Self-love is deeply gratified by the prospect of living forever, even as a clone.

Indeed this is one of the more maniacal attractions of cloning. Almost as maniacal are the reflections of one Richard Seed, a physicist who is in the process of setting up a cloning lab and fertility clinic in Japan's northernmost island Hokkaido. He says,

God made man in His own image. God intended man to become one with God. Cloning and the reprogramming of DNA are the first serious steps in becoming one with God.

Other less bizarre attractions include the attempt to 'replace' a lost child, produce a clone to provide tissue or organs for a dying child, allow single woman or lesbian self-cloning, add another mode of infertility treatment, or attempt the reproduction of artistic or intellectual prowess. There are serious problems with each of these proposals.

But perhaps the main reason why reproductive cloning is unlikely to escape a universal ban is safety. Currently, most formal bodies of inquiry into cloning conclude that reproductive cloning

is unethical; but one cannot help but feel that the reasons given are thin on the ground, that underneath some people really cannot see the problem.

The overt and almost passionate condemnation of reproductive cloning by some scientists, ethicists and assorted social commentators is only weakly coupled to sound reasoning. Is this because in their heart of hearts they do not consider the reasons for the opposition to reproductive cloning to be adequate, and when the time comes, and the public has been softened through therapeutic cloning, will they join those who reason in favour of reproductive cloning? The National Bioethics Advisory Commission in the United States opposed reproductive cloning primarily on the grounds of safety. However, once the techniques are perfected, safety may no longer be an issue, then what will remain as a reason to oppose the practice?

The truth is that when it comes to articulating the reasons for opposition to reproductive cloning, the discussions become complex and are ripe with many unknowns. Perhaps when it comes to the deepest and most profound of human characteristics and qualities our desire to uphold what we know and intuit to be true leaves us fishing for words. Is the common abhorrence to the notion of cloning a testament to that intrinsic knowledge of what it means to be human, and that cloning defiles that image?

Gyorgy Scrinis, in an essay published in *The Age*, entitled "*Cloning: just say no*", goes further, stating that,

Many people, however, still express a gut reaction against cloning, which has been condescendingly referred to as the "oh yuk" factor. But while it may be difficult to articulate why we are opposed to the idea of human cloning, there is a danger in thinking we must come up with "rational" or "practical" reasons for our opposition to it. ... Cloning is, to use the historian Ivan Illich's expression, one of the "unspeakable horrors" of the contemporary era. As Illich asserts, we do not need to articulate arguments for why we are opposed to such horrors. It is not a question of weighing up the possible psychological, biological or ecological "side-effects" associated with them.

Others, however, like Leon Kass do attempt an articulation of the meaning of reproductive cloning and the offence it raises. Speaking of the problem of playing God, he says,

Never mind the exaggeration that lurks in this conceit of man playing God: even at his most powerful, after all, man is capable only of *playing* God. ... if scientists are seen in this god-like role of creator, judge and savior, the rest of us must stand before them as supplicating, tainted creatures.

Playing God is serious enough, but reproductive cloning is also about the manufacture and commodification of human beings, it raises privacy issues, and interferes with what some call the right to an open future. Furthermore, how we began life holds relevance later in life. As Deal Hudson notes about Mary Shelley's well-known character:

Frankenstein reminds us that human beings will inevitably reflect upon the manner of their begetting, and in that reflection we inevitably confront the measure of our freedom.

Reproductive cloning may also carry psychological risks as it seriously confounds family structure and relationships. It would also represent expensive science in the face of other pressing medical problems and at the same time will broaden the opportunity for genetic manipulation.

These are serious issues that have received limited public attention, and part of the reason lies in the fact that currently the emphasis in the science of cloning is to be found elsewhere.

Right now the focus is squarely upon therapeutic cloning and for the meantime, especially given the enormous interest in therapeutic cloning, invested and other, reproductive cloning will most likely tread water. But it is important to remember that reproductive cloning is closely

coupled to therapeutic cloning and the likelihood of a slide from the latter to the former will be forever present.

But at the moment therapeutic cloning is where all the action is. The term therapeutic cloning is one that I believe should be done away with, combining as it does images of value, that is therapy, with a process reliant upon the destruction of human life. The word 'therapeutic' is laden with positive meaning. This confounding use of terminology has served to weaken opposition to the real meaning of the procedure. The use of the term 'therapeutic cloning' is an example of semantic gymnastics intended to create an artificial distinction between cloning which allows a cloned individual to be born, that is 'reproductive cloning', and that which destroys an embryonic human being. Both are reproductive cloning. To allow a distinction to be made in this way immediately implies a different status for the embryo that could be used to legitimise its destruction. But for the time being we are stuck with the terminology, widely used as it is.

To understand the meaning of therapeutic cloning, it is first necessary to diverge for a moment to examine the nature of human cells and their development. Mature human cells come in a wide variety of shapes and sizes, ranging from fat cells that cause us so much grief, to complex nerve cells with processes up to a metre in length. Mature cells such as these differentiate from more basic or universal cell types called stem cells. The ultimate stem cell is the embryonic stem cell found in the early embryo, which unsurprisingly gives rise to all of the 200 cell types in the mature adult human body.

Adult stem cells with many similarities to embryonic stem cells can also be found in adult neural tissue, blood, bone marrow, skin, pancreas and so on. Typically they give rise to a range of more specialised cell types on demand.

Until recently, conventional wisdom held that once differentiated, cells could not turn back from their mature form. Dolly, however, turned that notion on its head, showing that insertion of the nucleus from an adult fully differentiated cell into an empty egg cell reactivates the genes responsible for development. In a sense the cell is reprogrammed to day 1.

Human embryonic stem cells have been known about for some time, and typically display relatively uncontrolled behaviour by spontaneously differentiating into nerve, muscle and so on. Recently, however, researchers in the US have been able to tame the cells, maintaining them in culture for the first time, so that they are now maintained as immortal cell lines. The cells can currently be purchased from the University of Wisconsin for \$5000 for two vials along with a set of instructions about how to keep the cells indefinitely. Alternatively, there are ways of obtaining them via a contact in Singapore.

The original cells were derived from a so-called 'spare embryo' donated by a couple participating in an IVF programme. The embryonic stem cells reside in what is termed the inner cell mass of the pre-implantation embryo at about 5-6 days of age. Of course their removal destroyed the embryo. At about the same time, another group of researchers achieved similar results from an alternative source of very similar cells which were derived from the gonads of aborted fetuses. The ethical issues arising in the derivation of these alternative stem cells are somewhat different from those arising in the derivation of embryonic stem cells from an IVF embryo, and at least one of the difficulties relates to the influence that cells removed in this way may have upon any decision that a woman may make about whether or not to undergo an abortion.

The current excitement in the scientific community centres on the universal nature of embryonic stem cells and their inherent capacity to differentiate into more specialized cell types. When these cells are placed in a particular environment they tend to specialize into the same types of cells as exist in their surroundings. For example, researchers were recently able to stimulate regrowth in the damaged spinal cords of rats by injecting rat embryonic stem cells. The injected cells quickly turned into nerve cells and contributed to the repair of the damaged spinal cord, leading to a recovery of function.

It is the hope of research scientists that not only will embryonic stem cells be useful in this type of application, but that the various biochemical factors responsible for directing cells down a specific pathway may be identified and put to use producing cardiac, glandular, neural, pancreatic or other tissue. There are even those who intend for such cells to be put to work constructing whole organs outside of the body and thereby provide an endless supply of organs thus resolving the current organ shortage. However, at this stage the building, growth and maintenance of extremely complex organs such as hearts, kidneys, livers and pancreases is not about to happen in a hurry, and although speculation in this area is a risky business, it is hard to envisage a ready supply of human organs constructed from embryonic stem cells sitting on the shelf ready for transplantation within the next ten or even twenty years. But science is full of surprises.

But what do stem cells have to do with cloning, apart from the fact that both cloning and stem cell research have much to do with cell versatility and reprogramming? In short, what is therapeutic about therapeutic cloning?

If it did become possible and then routine for a wide array of human tissues and organs to be in abundant supply, then there still remains the problem of tissue rejection that remains so troublesome in transplantation. It may of course be possible to assemble banks of tissues or organs with enough variety to ensure sufficient compatibility, but the proponents of therapeutic cloning are keen to tell us there is a better way to go.

The problem with tissue rejection, we are told, would be resolved if tissues and organs could be constructed directly from the person requiring the transplant. The procedure would go something like this. A cell would be removed from the patient, its nucleus transferred to an enucleated or empty egg cell (that is a clone produced) and the resultant *in vitro* embryo allowed to develop to the blastocyst stage. At this point, at approximately 5-6 days, embryonic stem cells would be removed from the inner cell mass and grown in culture. The embryo is destroyed in the process. The embryonic stem cells would then be manipulated to become tissues or organs for transplantation back into the patient, in which case compatibility would be guaranteed since the cells have the same genetic constitution as the patient from whom they were derived in the first place.

It needs to be kept in mind that if this practice became widespread human eggs would be in demand, and greater pressure would be placed upon their commercialisation leading to sale for profit. It is not difficult to see that if that were to occur, then the most likely contributors for the procedure of egg harvesting, not without its medical risks, would be women in need of the accompanying financial gain, that is, women from lower socio-economic strata.

There can be little doubt that a huge and extensive research effort will be needed for therapeutic cloning to become a reality. At the recent Federal Inquiry into the Cloning of Human Beings, some of the scientists giving evidence suggested that the existing supplies of embryonic stem cells would be all that was required to keep researchers busy for many years to come. That may be true if research were strictly limited to studying the characteristics of human embryonic stem cells, but for therapeutic cloning to come to fruition as a medical, clinical procedure, large numbers of cloned embryos would need to be created and destroyed. Therefore in reality, therapeutic cloning represents a renewed call for embryo experimentation, and perhaps in this respect, therapeutic cloning is a stalking horse to get a broad acceptance of the creation and use of embryos for destructive experimental purposes thereby undermining State laws, which already prohibit this way of treating embryonic human beings.

Besides the obvious unethical use of human embryos central to therapeutic cloning, there is another problem that violates an important principle in bioethics. That principle, originally articulated by Kant, is that human beings must never be used as mere means to an end. They are ends in themselves, and for this reasons there is something additionally odious about therapeutic cloning in that the embryo is created and destroyed for the sole purpose of benefiting another

human being. Despite a good result possibly arising for the patient, this way of viewing and treating human life at its most vulnerable stage has a particular callousness to it.

In difficult ethical issues it is commonly agreed that when alternatives exist that hold similar promise, but at the same time do not present the same ethical difficulties, they ought to be pursued first. To put it bluntly, what is the point of pursuing research that many consider quite unethical, thereby stirring up a hornets nest, when good alternatives exist that don't raise issues of such gravity. There is an ethical imperative to first pursue those avenues that are morally less problematic. As Doerflinger notes:

Even among those who do not recognize the human embryo as having the rights of a person, it is widely held that harmful experiments must not be performed on the embryo unless they are the only feasible means for obtaining vitally important medical benefits.

Furthermore, the United States National Bioethics Advisory Commission (NBAC) likewise concluded:

Because of ethical and moral concerns raised by the use of embryos for research purposes it would be far more desirable to explore the direct use of human cells of adult origin to produce specialized cells or tissues for transplantation into patients.

But what hope is there that adult stem cells rather than embryonic stem cells will prove to be of value in the search for self-compatible tissues and organs? Recent studies suggest that the prospects are looking good.

Take for example the recent finding in mice that adult pancreatic stem cells could be removed, grown in culture and then transplanted into a strain of diabetic mice, thereby reversing the diabetic state. Add to this the fact that the researchers are confident, based upon preliminary experiments with human tissue, that similar results may be obtained in humans, one day perhaps bringing an end to daily insulin injections.

Studies at Harvard Medical School have shown that mouse neural stem cells can be injected into the brains of mice with a degenerative disorder, and the abnormal cells replaced by a large number of normal cells. In an interesting twist, neural stem cells could be coerced into becoming blood cells, including cells carrying out an immune function such as B and T lymphocytes. As Malcolm Moore from the Memorial Sloan-Kettering Cancer Center in New York states:

Lineage-defined progenitor cells in adult tissues may be more plastic than hitherto thought. They might have the capacity to de-differentiate, or be reprogrammed, becoming totipotent stem cells.

More recent research in Sweden has shown that mouse neural stem cells can be nurtured to become heart, liver, muscle, and other tissues. Conversely, neural cells or even liver cells have been derived from bone marrow stem cells in research in the US and Britain, respectively.

In this burgeoning area, it is therefore becoming apparent that adult stem cells present a viable alternative to embryonic stem cells in the preparation of new tissues and perhaps one day, new organs for transplant.

It is sometimes argued, however, that using embryonic stem cells is really much easier than pursuing the more arduous path of isolating adult stem cells and redirecting their development. However, to be blunt, if ease is the issue, it would be a whole lot easier to solve the organ supply problem by forcing say prisoners to donate organs. Furthermore, the use of embryonic stem cells is only easier because of current practices already considered unethical by many people, such as the production of extra embryos in IVF treatment.

But for those who consider that the greatest promise resides in embryonic stem cells, there has for them arisen an ethical *imperative* to use embryonic stem cells. And this imperative is driven by the underlying belief, contrary to embryology, that the embryo is little more than a collection of cells. Juliet Tizzard from the Progress Educational Trust pulls no punches when she says:

But the most important argument in favour of stem cell research and treatment is that it is ethically right. Human embryos, just a few days after fertilisation, might be human, but they're not people. They simply do not - and cannot - have the same rights as we do. And so, if human embryos can be used to better understand and, ultimately, to treat human ailments, it is ethically right and proper to do so. In fact, given that the promise of stem cell therapies is so great, it would be ethically unacceptable not to do so. Fiddling while Rome burns is simply not an option.

Julian Savulescu of the Murdoch Institute reiterates this table-turning sentiment and adds the following words to his argument in favour of therapeutic cloning:

We are running the risk that our children will be denied the benefits of this research because of the moral beliefs of a minority, selectively applied.

Interestingly, Savulescu bases his argument primarily upon the widespread prevalence of abortion in which embryos and fetuses are likewise destroyed, and upon the prevalence of so-called 'spare' IVF embryos, which would go to waste otherwise and therefore should, in Savulescu's opinion, be put to good use. Here we have a perfect example of slippery slopes in action, where unethical practices, now common, are used to justify further unethical practices.

If the terms 'therapeutic cloning' and 'reproductive cloning' are taken up and formalised in various position statements, and perhaps law, there is every reason to expect an expansion of the context of therapeutic cloning to include foetuses, particularly given the fact that it would be much easier to allow organs to develop 'naturally' in the cloned foetus before harvesting, rather than attempt the extremely difficult technical process of organogenesis *in vitro* from embryonic stem cells. There have already been calls for the harvesting of organs from foetuses, and indeed the position statement on cloning by the Australian Academy of Science, while not proposing reproductive cloning of fetuses or born humans, does allow for therapeutic cloning to include destructive embryo experimentation up until eight weeks of age.

If cloned foetuses were ever allowed to develop, the next seemingly 'natural' consequence would be to allow cloned embryos to be implanted and develop till birth. Even if 'therapeutic cloning' was permitted and 'reproductive cloning' banned, it is hard to imagine that once our IVF clinics and research facilities are replete with cloned embryos, someone will not try implantation and full pregnancy cloning. For those who consider allowing the birth of a cloned individual to be acceptable or even in some cases ethically demanded, this would be a small and relatively easy step to take. Certainly, those in favour would argue for full reproductive cloning on therapeutic grounds, perhaps initially to produce a child for compatible bone marrow transplantation into a dying sibling.

Furthermore, without legal parity from one country to the next, a supply of cloned embryos from one country could easily be transported to another where full pregnancy cloning might be allowed, or at the very least be minimally restricted.

Currently, therapeutic cloning seems likely in the UK, and is under serious consideration here in Australia. All this, when no one claims yet to have actually successfully produced a cloned human embryo. But the forces behind the proposed legislative changes are powerful, and perhaps it is time all cards were laid on the table with respect to various interests in therapeutic cloning. After all, biotechnology is big business and the financial prospects for certain companies and individuals are very bright. But financial interest is not the only kind of interest that individuals can have. Careers, grant money, travel and kudos are all factors, which have the potential to influence

decision making, even in serious matters such as this. The potential for judgement to be clouded is very real, and ought to be factored in.

There are a few remaining developments which must rate a mention in this discussion.

First, the introduction of human genetic material into a cow's egg, and its subsequent development to the 16-32 cell stage. It has been argued that this type of experiment avoids certain ethical dilemmas by obviating the need for human eggs. Dorothy Wertz states that:

... use of cows eggs to jump-start human cells for possible organ transplantation will actually be the most ethical approach to date.

To reduce such a serious ethical issue to 'jump-starting' human cells is to miss the import of combining human genetic material with animal cells, which themselves, although enucleated in this case, will also include a component of bovine genetic material.

There are reasons behind the immediate "yuk" factor experienced by many about the mixing of human and animal cells or gametes. It is not just the concern, however valid, about the nature of the developing embryo, and what it could be, confounding as it does our defining sense of what is animal and what is human; but more deeply it is an affront to human dignity, a dignity perhaps best understood in terms of the value or worth of human life and its distinction from the rest of the animal kingdom. Reductionist notions of human life as mere molecules or biochemical machinery have little to say about the deeply held respect for human life that is the hallmark of most of humanity's highest endeavours and achievements.

Second, the development of headless mice successfully brought to birth but which died soon after, raises the possibility of the same process carried out in humans. Lee Silver, a biologist from Princeton University, considers such a shift quite feasible. In this way therapeutic cloning could be carried out for the supply of organs from the born human being, who on the count of some, would not be a moral being, as there would not be sufficient brain with which to be sentient. While our innate abhorrence to such a notion seems to us to be so obviously grounded in our moral sensibility, the moral sensibilities of others see no problem. Lee Silver continues by saying that:

These human bodies without any semblance of consciousness would not be considered persons, and thus it would be perfectly legal to keep them "alive" as a future source of organs.

Third, and returning to earlier suggestions that cloning may provide a unique opportunity for genetic manipulation, scientists in Scotland have recently worked out a precise method for the delivery of human genes, meaning that they "are on the verge of being able to add, subtract and replace genes at will." It has been suggested that these developments could be used to produce cloned healthy offspring from parents with genetic flaws. In this way scientific methods in cloning will be married to advances in the manipulation of genes and hence pave the way for a more invasive engineering of human beings.

In conclusion, the clonal age is here, running mate with genetic engineering, so historically uniquely positioned as to challenge long-held and foundational concepts of humanness. In our pursuit of betterment, will humanity realize its goals? Kass likens that quest to an heroic yet tragic endeavour in which the outcome may be unexpected. He says:

As Aldous Huxley made clear in his prophetic *Brave New World*, the conquest of disease, aggression, pain, anxiety, suffering, and grief unavoidably comes at the price of homogenisation, mediocrity, pacification, trivialised attachments, debasement of taste, and souls without love or longing. Like Midas, bioengineered man will be cursed to acquire precisely what he wished for, only to discover – painfully and too late – that what he wished for is not exactly what he wanted. Or, worse than Midas, he may be so dehumanised he

will not even recognise that in aspiring to be perfect, he is no longer even truly human.

Dr Gregory K Pike
Deputy Director, Southern Cross Bioethics Institute
August 2000