

OPINION

HUMAN CLONING - THE LAW'S RESPONSE

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The Breakthrough

Ian Wilmut, Keith Campbell et al startled the world when they announced in February 1997 that they had cloned a lamb using a cell nucleus taken from an adult ewe's udder.¹ They also startled a generation of researchers who believed it to be impossible to create whole new organisms from single adult cells. The accepted wisdom had been that cells from adult animals could not be reprogrammed to make a whole new body.²

Dolly the lamb's birth thus represents an ethical and scientific watershed. Worldwide, there has been a torrent of reaction and overreaction to the event. Advisory committees and legislators around the world are frantically trying to decide whether and when it might be ethical to duplicate the feat in humans. It has also shattered traditional wisdom, eg. that life begins at conception.³

Cloning Technique

Dogged persistence was an important element in the Roslin team's success. They performed two hundred and seventy seven nuclear transfers on egg cells before they achieved success with Dolly. The technique involved removing the nucleus from an egg cell and replacing that nucleus with one that had been excised from the mammary cell of an adult sheep. They then applied an electric current which caused the egg and its new nucleus to fuse and develop into an embryo. Embryos which were successfully created in this way were implanted into surrogates. Dolly was the only lamb born from this series of implantations.⁴

She is virtually an identical copy of the adult sheep whose mammary cell was used in the experiment. It is this fact which characterises her as a clone. Dolly can be described as a laterborn identical twin, but unlike twins

1 Wilmut I, et al, 'Viable offspring derived from foetal and adult mammalian cells' (1997) 385 *Nature* 810-813.
2 Beardsley T, 'The Start of Something Big?' (1997) *Scientific American* 10; Holden C, 'Mary had a little - clone' (1997) 275 *Science* 1271.
3 Ibid.
4 Wilmut I, above n 1, 810-813.

which occur naturally there is some genetic difference between Dolly and her twin.⁵

Prior to this experiment it was universally believed that a mammal could not be cloned from an adult cell. The reason for this is that embryo cells are totipotent, ie. capable of becoming any and every cell in the body, whereas adult cells are differentiated. This means that in the latter type of cell, that forms the skin, muscle and brain for example, genes are not needed to perform the required specialised function and are switched off. In contrast to this, an undifferentiated cell can give rise to any cell in the body because it is capable of activating any gene on any chromosome.⁶

In order to succeed with their experiment the Roslin team had to trick the adult cells' DNA into reverting to its undifferentiated past. They achieved this by placing the mammary cells in the culture and starving them of nutrients for several days. This regime apparently encouraged the genes to switch off. When the nuclei were removed from the adult cells placed next to the enucleated egg cells, and fused by electricity the eggs were able to reprogram the donor nuclei into behaving as if they had come from undifferentiated cells. The precise mechanism of this reprogramming is still not precisely understood.⁷

Should Humans be Cloned?

An inescapable inference to be drawn from Wilmut's research is that it is now possible to clone a human being. There is no *a priori* reason why humans should behave very differently from other mammals which have been successfully cloned. There is therefore no reason why an adult human could not be cloned using Wilmut's technique.⁸

Genetic Inheritance

The overwhelming desire for individuals not only to have children, but to have children who carry their genes is stronger than ever. ICSI (intracytoplasmic sperm injection) which allows a single sperm to be injected directly into an oocyte has enabled sterile men to achieve biological descendants. The perception has also become more entrenched that a person's personality is largely determined by their genes.⁹

However, in instances of severe sterility such as dysplasia or severe testicular atrophy or, indeed, in the case of lesbian couples, there is no male germline which exists. Techniques such as ICSI will not assist couples who

5 Klotzko AD, 'The Debate About Dolly' (1997) 11 *Bioethics* 427.

6 Holden C, above n 2, 1271.

7 Wilmut I, above n 1, 810-813.

8 Kahn A, 'Clone mammals - clone man?' (1997) 386 *Nature* 119.

9 Kahn A, above n 8, 119.

find themselves in this position yet demand a right to biological descendants.¹⁰

If Wilmut's technique were applied directly to humans, it would yield a clone 'of the father' and not a shared descendant of both the father and the mother. Nevertheless the act of carrying a foetus can, for a woman, be as important as being its biological mother. This is evidenced by the strong demand for pregnancies in post-menopausal women and for embryo and oocyte donations to circumvent female sterility. Moreover, if cloning techniques were ever to be used, the mother would contribute something: her mitochondrial genome.¹¹

The Reaction to the Cloning Breakthrough

There has been a massive response to the announcement of Wilmut's achievement. The initial response in many quarters was typically reactionary and negative with calls for the outright banning of human cloning. Once the dust had settled and some rational thinking had emerged on the potential benefits of human cloning, a measure of qualified support started to emerge.

What is the debate that is just starting on cloning about and why is there so much heat and so little light at present? The fundamental reason is that it deals with the fate of human reproduction which is now possible in an entirely a-sexual process. This in turn has challenged the deep rooted sense of reproductive exclusivity, the reason for being of both mankind and womankind, the basic urge to reproduce the species, the urge to survive which constitutes the driving force in the individual psyche.¹²

The last frontier in medicine is currently being challenged viz the unravelling of the human genome. This task is being accomplished by pure scientists rather than medical scientists. Cloning is an offshoot of this research as is the understanding of the genetic structure of cells. This in turn has led to the discovery that each cell in a human body contains in it the blueprint to produce an exact replica of that person.¹³

As this last frontier recedes and society sees glimpses of the new horizon emerging from the gloom, it is understandably frightened by the yet uncertain and murky picture it sees. And thus instead of applying the accelerator of progress it relies instead on the brake of law to slow its momentum.¹⁴

The institutional response to cloning has been, given the implications of the realities that could flow from it, predictably reactionary. Europe and

10 Ibid.

11 Ibid.

12 Wolf SM, 'Ban Cloning?' Why NBAC is Wrong' (1997) 27 *Hastings Centre Report* 12,13.

13 Kirby M, 'Challenges of the Genome' (1997) 20 *UNSW Law Journal* 537.

14 Klotzko AD, above n 5, 431.

the USA have adopted the ‘... we are frightened of the unknown horizon’ approach to dealing with the issue and rushed to legislate and thus banish the problem. They have sought motivation for this approach by resorting to the Kantian philosophy, ie. that it is the sort of technology that will destroy human dignity were it allowed to be utilised.¹⁵ It will be a great tragedy if we allow the cornucopia of benefits that can be derived from cloning to be lost just because of philosophical misgivings about its use as a tool of reproduction.¹⁶

The Negative Response

US Executive Ban

President Bill Clinton announced an executive ban on federal funding for ‘cloning human beings’ on 4 March 1997. Clinton also called for a voluntary private sector moratorium on human cloning until the National Bioethics Advisory Commission (NBAC) had considered the issue. The announcement had clear political overtones and was intended to respond to the initial public outrage.¹⁷

Proposed Legislation

Shortly after President Clinton’s executive ban, Christopher Bond (Rep. Missouri) introduced a bill to block federal funds for ‘research with respect to the cloning of an individual’. The bill defined cloning as ‘the replication of a human individual by the taking of a cell with genetic material and the cultivation of the cell through the egg, embryo, foetal and newborn stages into a new human individual.’¹⁸

The above legislation was soon followed by two bills introduced in the House of Representatives by Vern Ehlers (Rep. Mich). The first sought to ban federal funding for anyone who ‘uses a human somatic cell for the process of producing a human clone’. The second sought to impose a \$5000 fine on anyone attempting such work. Neither bill defines ‘human clone’.¹⁹

Ehlers justified his bill by saying that ‘if we don’t ban immediately research on cloning humans, we are likely to see a strong movement to ban research on cloning in general’.

Conversely, Roger Pedersen, a developmental geneticist at the University of California, San Francisco, responded to the bills as follows

15 Callahan D, ‘Cloning the Work Not Done’ (1997) *Hastings Centre Report* 27.

16 Campbell CS, ‘Prophecy & Policy’ (1997) 27 *Hastings Centre Report* 15.

17 Wadman M, ‘Politicians accused of ‘shooting from the hip’ on human cloning’ (1997) 386 *Nature* 97.

18 Wadman M, above n 17, 98.

19 Wadman M, ‘US Senators urge caution on cloning ban’ (1997) 386 *Nature* 204.

'[they] ... will certainly stifle the research on human cells in culture that could give vast benefit to people'. The bills are further described as 'disastrous' because their use of the term 'human clone' technically applies to any cell population arising from a single ancestral human cell, which could have far reaching effects on existing (accepted) research in embryology. A further knock on effect of the bills is that they could block current studies in cellular senescence (aging) as well as efforts to culture stem cells to provide tissues for auto-transplant.²⁰ This research could produce results of enormous therapeutic value to mankind.²¹

Report of National Bioethics Advisory Commission

The Chairman of the Commission reported to President Clinton in June. In general terms the report urged that human cloning should be banned in the US, but that the laws to control the practice should be flexible enough to allow a rethink in the future.

According to the recommendations, however, researchers in the private sector would be permitted to make cloned embryos for experimental work on condition that they were destroyed and never implanted.

The moratorium on government funding for human cloning research should be maintained, but if voluntary compliance is unsuccessful, laws to regulate cloning might be required.

If laws to regulate cloning were to be passed, the Commission suggested that they be reviewed every three to five years to take account of advances in animal cloning, so as to ascertain whether these techniques were not safe to be used in people.²²

Europe's Reaction

In strongly worded statements, Germany's research minister, Jürgen Rüttgers, backed a call by French President, Jacques Chirac, for a worldwide ban on human cloning. Rüttgers also appealed for the Council of Europe's Convention on Bioethics to be modified so as to ban cloning specifically.²³

It is therefore hardly surprising that the European Parliament rushed through a resolution banning cloning motivated by a belief that it was essential to establish ethical standards based on respect for human dignity, in the areas of biology, biotechnology and medicine. It is interesting to note that they failed to provide a single argument to substantiate how the idea of human dignity is relevant to the ethics of cloning.²⁴

20 Wadman M, above n 17, 98.

21 Kleiner K, 'Dolly starts a stampede in Congress' (1997) *New Scientist* 4.

22 Coghlan A, 'Cloning report leaves loophole' (1997) 14 June *New Scientist* 7.

23 Butler D & Schiermeier Q, 'Ruttgers and Chirac seek cloning ban' (1997) 387 *Nature* 111.

24 Harris J, 'Is cloning an attack on human dignity?' (1997) 387 *Nature* 754.

Existing legislation in Germany viz the Embryo Protection Act 1990, prohibits cloning of humans. The European Commission's Advisory Group on Biotechnology has launched an investigation of its policy on genetic research to determine whether the regulations need tightening.²⁵

Emotional Reaction

The flood of calls for an international ban on the use of cloning techniques for reproduction appear to be based on 'science fiction accounts' which have instilled fear and ignorance in the general public.²⁶

The widespread political opposition to cloning has, according to Giuseppe Benagiano, Director of the WHO programme on research in human reproduction, resulted in rational debate on the topic falling victim to emotion and politics.

The WHO Report regrets the fact that legislators and policy makers have acted from 'moral panic' rather than considered deliberation, and adds that a ban or moratorium hastily imposed could result in the loss of actual or potential benefits. The benefits, they argue, have been underestimated while the risks have been overstated.²⁷

Ethics and the Law's Approach to Cloning

The press has sensationalised their reports on the possible outcome of Wilmut's breakthrough and this has caused alarm amongst legislators and politicians which in turn has led to a rash of hasty bills submitted to legislatures to ban cloning of humans. The problem with rushing to legislate is that the fundamental tenet of a democracy is being overlooked viz that there should be a balanced public debate which will then capture the *boni mores* of the public and distil the ethics of the issue. The legislators will, at the end of this process, have the good, considered reasons they need to legislate for the restriction of scientific progress.²⁸

From the tactical point of view, the present public perception that human cloning constitutes a Pandora's box which, if ever opened, would unleash a spate of unpredictable consequences is a fact that must be dealt with and it is submitted that the public must be given time to become accustomed to the cloning of animals, and that there should be a temporary moratorium on research into human cloning.²⁹

25 Ibid.

26 Butler D, 'Calls for human cloning ban stem from ignorance' (1997) 387 *Nature* 324.

27 Ibid.

28 Butler D & Wadman M, 'Calls for cloning ban sells science short' (1997) 386 *Nature* 8.

29 Butler D, above n 26.

Perhaps now that the dust has settled and the emotions have been vented, the debate can move to determining the ethical problems surrounding human cloning and whether it is in fact 'contrary to nature' as is frequently alleged. This argument fails to take into account the fact that man has manipulated animals to serve his own purposes for generations.³⁰

Another argument raised against human cloning is that it attacks the fundamental principles of 'human dignity' of an individual. It is submitted that this can be construed as an apology for genetic determinism as it ignores the influence of 'nurture' on personality. One should never lose track of the fact that human clones would not, strictly speaking, be identical as they would be born a generation apart and thus be exposed to different environmental influences. This means that a clone of Hitler would not necessarily become a dictator, and a clone of one's father would not actually be one's father, as his relationship would not be a parental one.³¹

An important outcome of the debate on cloning is that scientists are starting to fight back against what they claim is an increasingly unjustified stigmatisation of the potential dangers of genetic research.³²

Part of the reason for the reaction was that the scientific community were so totally unprepared for Wilmut's feat of cloning a mammal from adult tissue that they did not have immediate answers to all the issues it raised.³³

Potential Benefits of Cloning

Much of the opposition to cloning is based on the perception that the benefits of human cloning would be few, whereas the risks of abuse could be large. It is, however, submitted that the benefits are being underestimated while the risks are overstated.

Following on the birth of Dolly the same team of scientists at the Roslin Institute cloned lambs from foetal, rather than adult, cells. Three were born from this process. The added significance of this particular achievement was a big step towards developing domestic animals with designer genomes. What distinguishes these lambs is that they carry an extra gene, a few even have a human gene that the researchers introduced into the cells before they were cloned.³⁴ The great potential for this marriage of cloning and genetic engineering is that it facilitates the production of human proteins such as blood clotting factors and fibrinogen which aids in healing wounds on a cost effective basis.

30 Ibid.

31 Beardsley T, above n 2, 11.

32 Butler D, above n 26, 324.

33 Ibid.

34 Ibid.

The birth of these lambs has proved that the foreign (human) DNA in the fibroblast genome did not disrupt the genetic instructions that guide the lambs' development. The next step is to conduct clinical trials in order to prove that the proteins or cells produced by these animals are safe and effective.³⁵

Cloning techniques would allow for rapid progress to be made in basic research in areas such as what switches genes on and off during development, as well as in the production of animal models for studying human diseases.³⁶

It has also been established that cloning techniques could be used to generate skin grafts for burn victims and bone marrow for patients undergoing cancer therapy.³⁷

Dolly's existence has also raised the question as to whether cells from patients can be reprogrammed to make genetically compatible therapeutic tissue, such as brain tissue of the type that is destroyed in Parkinson's Disease.³⁸ In five to ten years' time cloning techniques should be sufficiently advanced so as to be used to generate tissue for organ replacement.³⁹

Wilmut's technique might also help to reveal how the environment within the cells of an early embryo regulates gene function. Such information may in turn eventually help in combating genetic diseases by allowing researchers to turn good genes on and bad genes off.⁴⁰

Cloning could also be a source of assistance to infertile couples in situations where both partners lack gametes. In these cases cloning would provide an alternative to the current practice of embryo donation. It could also be used by couples where the male partner lacks gametes, as it might be considered preferable to using donor sperm.⁴¹

Couples in the process of *in vitro* fertilisation therapy may also wish to use cloning to generate extra embryos which will increase the chances of fertilisation in cases where the female partner has only a few oocytes.⁴²

Futuristic Scenarios

Cloning of the Dead?

35 Pennisi E, 'Transgenic lambs from cloning lab' (1977) 275 *Science* 1733.

36 Butler D & Wadman M, above n 28, 8.

37 Ibid.

38 Beardsley T, above n 2, 11.

39 Marshall E, 'Mammalian cloning debate heats up' (1977) 275 *Science* 1733.

40 Ibid.

41 Butler D, above n 26, 324.

42 Ibid.

Henrik Callesen leads a team at the Viborg Laboratories in Denmark and Alan Trounson of Monash University in Clayton, Victoria, also heads a team which is attempting to clone cows with the DNA extracted from the cells of cattle which have been dead for around half an hour.⁴³

The Danish researchers take two types of cells from the freshly slaughtered animals. First they extract immature, unfertilised eggs (oocytes) from which the DNA is excised. Then they take adult cells from the cows' ovaries which are used as donor cells to provide the genetic material for the cloned cow.⁴⁴

They then proceed to fuse the donor cell with the empty oocyte by exposing them to an electric current while they are touching. It then takes about a week for the fused cell to grow into an early stage embryo called a blastocyst, after which the blastocyst is implanted into the womb of the foster mother. The Australian group's technique is similar.⁴⁵

If this technique is perfected in animals, it immediately raises the question as to whether it may not also be applied to dead humans. Trounson dismissed the idea that that was a direction being contemplated by research scientists. He stressed instead the advantages of perfecting the technique in animals viz that once cows can be cloned, it will be possible to mass produce cattle that have been genetically engineered to produce drugs such as Interferon in their milk at a much cheaper rate than they can currently be manufactured.⁴⁶

Cloning for Spare Organs

The technology exists for scientists to clone embryos, implant one of them and to cryopreserve another to be used as spare organs or tissues for its twin should the former ever need them. However, the creation of human clones solely for spare cell lines would, from a philosophical point of view, contradict the ethical principle of human dignity expressed by Kant. This Kantian principle demands that an individual human life should never be thought of as only a means but at all times as being an end. Creating human life for the sole purpose of its serving as a source of therapeutic material would not serve the dignity of the life so created and fails the Kantian test.⁴⁷ However, individuals in certain cultures might find the production of clones of early human life for spare parts acceptable.⁴⁸

Cloning as a Form of Reproduction

43 Coughlan A, 'Will cloned cows rise from the dead?' (1979) *New Scientist* 5; Cohen J, 'Can Cloning help save Beleaguered Species?' (1997) 276 *Science* 1329; Kahn P & Gibbons A, 'DNA from an Extinct Human' (1997) 277 *Science* 176.

44 Ibid.

45 Ibid.

46 Ibid.

47 Butler D, above n 26.

48 Shapiro HT, 'Ethical and Policy Issues of Human Cloning' (1997) 277 *Science* 195.

Analysing the use of cloning humans as a means of combating sterility presents a number of problems because, in this instance, the goal is to create life with a right to dignity. It is also accepted as incontrovertible that an individual is not determined entirely by its genome but that its family, cultural and social environment have a powerful 'humanising' influence on the child's eventual personality. In other words, two human clones born decades apart would have markedly more different psychological make-ups than would identical twins raised in the same family.⁴⁹

Wilmut's views on human cloning are that he would only condone it in order to avoid genetic disease caused by mutations in mitochondria ie DNA-bearing structures lying outside cell nuclei.⁵⁰

John C Fletcher of the University of Virginia submits that society is likely to find cloning acceptable to enable a couple to replace a dying child or, for a couple one of whom is infertile, to clone a child from either partner.⁵¹

The moral appropriateness of human cloning can be examined in three dimensions:

Wholeness

Our society has progressed a long way down the road of positive eugenics or the preferential breeding of superior genotypes. This currently occurs by aborting damaged or defective foetuses. This practice in turn raises a number of problems: which defects are intolerable? Who decides? But the critical view in embracing eugenics is that it results in a perversion of our attitudes eg. we begin to value the person in terms of the particular trait he or she was programmed to have. In short, we reduce the whole to a part.⁵²

Individuality

A characteristic of the human race is the uniqueness and diversity (sexual, racial, ethnic and cultural) of its composition. From a theological point of view we are created in the image of God.

It is said that if eugenic breeding schemes are embarked on, they would bypass and downplay humanity's uniqueness and diversity and should be avoided.⁵³

49 Kahn A, above n 8, 119.

50 Beardsley T, above n 2, 11.

51 Ibid.

52 McCormick RA, 'Should We Clone Humans?' (1993) *Christian Century* 1148.

53 Ibid.

Life

It is generally accepted that a human embryo prior to implantation (preembryo) is human life, albeit not yet a person, and, as such, should be treated with respect and, in certain circumstances, protected.

The extent of the protection and the basis for its protection is based mainly on the argument of the embryo's potential to develop through the various stages of growth in the gestation period to reach full personhood. The other argument is the knock-on effect which a disregard for sanctity of the preembryo will have for our own human condition. It is argued that medical technology (progress) has a way of establishing irreversible dynamics.

Critics of human cloning are thus concerned of what its effect will be on humanity's sense of wholeness, individuality and sanctity.⁵⁴

Legal Reaction

Wilmot's technique of cloning by using adult cells has generated a good deal of uncertainty as to whether the scope of existing laws is sufficient to outlaw cloning.

United Kingdom

The Human Fertilisation and Embryology Act 1990 is geared to prohibiting the cloning of embryos, whereas Wilmot's technique, because it uses adult cells in its process, arguably falls outside the scope of the 1990 Act. The Act stipulates that an embryo may not be created outside the human body without authorisation which in turn will not be given for the purpose of 'replacing a nucleus of a cell of an embryo with a nucleus taken from a cell of any person, embryo, or subsequent development of an embryo.'⁵⁵

South Africa

The only legislative provision which might be applicable to the cloning of humans is s39(A) of the Human Tissues Act⁵⁶ which states that:

Notwithstanding anything to the contrary contained in the Act or any other law, no provision of this Act shall be so construed as to permit genetic manipulation outside the human body of gametes or zygotes.

54 Ibid.

55 Maswood E, 'Cloning technique reveals legal loophole' (1997) 385 *Nature* 757.

56 Act 65 of 1983.

Would this provision outlaw Wilmut's cloning technique were it applied to humans? It is submitted that it would not because his technique involved taking the nucleus from a developed udder cell (an adult cell) and inserting it into an oocyte, the nucleus of which has been removed.⁵⁷

It is clear that this technique does not involve the manipulation of a zygote, nor does the enucleation of a oocyte constitute genetic manipulation. The oocyte's only involvement is the role of its cytoplasm in reprogramming the introduced nucleus and in contributing intracellular organelles - mainly mitochondria - to the future organism.⁵⁸ So on a narrow interpretation, South African legislation in its present form does not prohibit human cloning.

Section 12(a) of the Bill of Rights in the Constitution⁵⁹ reserves for each person the right '...to make decisions concerning reproduction'. It is doubtful whether the right is strong enough to serve as a basis for challenging future legislation which might prohibit human cloning. The most likely interpretation is that it reserves a right to choose from all sanctioned forms of reproduction, not from any form of reproduction.

Conclusion

It is clear that the Roslin breakthrough is another example of science having caught the law off guard and that legislation will be required to regulate the use of new technology to clone human beings. What is vital however, is to maintain a balance in this legislation which preserves and encourages the positive aspects while curbing the potential excesses. In so doing, important constitutionally enshrined values must be preserved such as the freedom of scientific inquiry⁶⁰ and the right to make decisions concerning reproduction.⁶¹

It is thus submitted that any future legislation which is adopted should be crafted around protecting and preserving the following key values:

- Encouraging the possible development of new biomedical breakthroughs.
- Protecting the freedom of scientific enquiry.
- Maintaining the individual's right to privacy.
- Protecting the widest possible sphere of personal choice in matters pertaining to procreation and child rearing.

57 Wilmut et al, above n 1 at 810-813.

58 Kahn A, above n 8, 119.

59 Act 108 of 1996.

60 The Constitution of the Republic of South Africa Act 108 of 1996 s16(1)(d).

61 Ibidem at s12(2)(a).

Although the technique now exists to clone humans, it is submitted that it would be premature to permit human cloning at this stage. More research needs to be done to ascertain the potential psychological harm to children created in this manner resulting from a possibly diminished sense of individuality and personal autonomy.

It is submitted that all research on cloning which has passed scrutiny on ethical committees should be permitted to continue, but that any attempt to create a child through cloning by somatic cell nuclear transfer be prohibited subject to a review of progress in research every three years.⁶²

Any laws or regulations which are formulated should be done in such a way that they do not interfere with the cloning of human DNA sequences and cell lines, as these activities do not impinge on any ethical issues and are making important contributions to scientific biomedical progress. The same is true for research on cloning animals.

In order to win public confidence and to lay to rest the scaremonger sensation stories that circulated after Wilmot's achievement was first announced, a process of providing information and education to the public in the field of genetics and biomedical sciences should be launched. They should especially target the areas of interface between genetics and cultural practices, values and beliefs. This task is important because human cloning goes to the very nature of what it means to be human as well as to the very heart of what people think of as their families and their individuality.

If we act in this two-pronged way by delaying the implementation of cloning and educating the public, we will rescue the research and its enormous potential benefits, which might be suppressed and thus lost solely because it conflicts with some peoples' religious beliefs.⁶³

62 Shaprio HT, above n 48 at 196.

63 Holden C, 'Scholars Group Defends Cloning' (1997) 276 *Science* 1341.