SHOULD YOU CLONE YOUR DOG? AN ANIMAL RIGHTS PERSPECTIVE ON SOMACLONING

G Varner

Department of Philosophy, Texas A&M University, College Station, Texas 77843-4237, USA

Final Acceptance: 6 May 1999

Abstract *Animal Welfare 1999, 8:* 407-420

This paper uses the Missyplicity Project's detailed Code of Bioethics *as a starting point for discussion of animal rights perspectives on cloning. Although funded by a couple in order to clone their pet dog, the project has more important collateral goals and forms part of a general line of research that, if successful, promises enormous clinical benefits to humans.*

A particular type of animal rights perspective is described and used to evaluate this project. This perspective accepts a 'principle of axiological anthropocentrism' (PAA), according to which only human beings have certain interests, or a kind of value, which is of pre-eminent moral significance. The best-known animal rights views (those of Singer and Regan) are shown to be consistent with the PAA. This perspective also denies that potential characteristics qualify their possessors for the same type of moral respect as actualized characteristics.

The balancing of potential benefits against risks to research subjects is discussed and it is concluded that, from the particular ethical perspective adopted in this paper, cloning research of this general type is not particularly problematic; and, given its stringent Code of Bioethics, *only an abolitionist perspective could condemn the Missyplicity Project in particular.*

Keywords: *animal rights, animal welfare, cloning, ethics*

Introduction

The Missyplicity Project site appeared on the World Wide Web (http://missyplicity.com) in August 1997, describing a wealthy couple's plan to clone their dog, Missy. Although the first hyperlink on the page asks 'Is this a joke?' the anonymous couple indeed issued a request for proposals that month – and a year later it was announced that a team of scientists at Texas A&M University had been selected to receive the initial funding of over $2 million across two years. The website includes lengthy anecdotes about Missy and even video clips of her frolicking at the beach. 'Her humans' (as the site puts it), think she combines great intelligence and beauty with a very sweet and gentle temperament. However, she was an adopted stray of uncertain lineage and because she had been spayed, the only way to pass on whatever influence her genes had on her intelligence and temperament was to clone her. With Dolly the cloned sheep fresh in the news, the couple was willing to put millions into the effort, but the project has the additional goals of using the perfected technology to clone service dogs and endangered canids as well as to 'develop relatively low-cost commercial

dog-cloning services for the general public.' The first paragraph of the project website describes it as 'strongly ethics-driven' and its *Code of Bioethics* places great emphasis on the well-being of the animals used, including, among other things: stipulations that 'no animals will be intentionally harmed at any point during this project', that people be hired specifically to play with the dogs outdoors for a minimum of 1h each day, that dogs' participation in the project be limited to 8 months, and that 'at the completion of their role ... [they all be] placed in loving homes' as pets.

This paper uses the Missyplicity Project's code of bioethics as the starting point for a discussion of an animal rights perspective on cloning research. The specific perspective adopted here includes a postulate of 'axiological anthropocentrism' (PAA; the view that only human beings have certain, pre-eminently important interests) and denies the moral relevance of merely potential (as yet unactualized) characteristics of embryos. Certainly, many animal rights advocates will disagree with one or both of those features of the perspective, and just as certainly both animal advocates and researchers will disagree with some of the specific claims made below about cloning and other animal research. The goal of this paper is not to show that all animal rights advocates should welcome cloning research, but only to show that much research on cloning which uses animals, and certainly the specific work undertaken in the Missyplicity Project, can be consistently endorsed from an animal rights perspective. The specific perspective adopted here will also be shown to be consistent with the two most widely discussed animal rights philosophies (Regan [1983] and Singer [1990]).

The postulate of axiological anthropocentrism (PAA)

Discussions of animal rights and environmental ethics commonly employ the concept of anthropocentrism, but in two different senses. Sometimes it is claimed that traditional Western ethical theories are anthropocentric in the sense of denying that non-human animals and the rest of nature have any intrinsic value or moral standing at all. At other times it is claimed that Western moral theory has been anthropocentric in the more limited sense of holding that only human beings have certain interests, or a kind of value, which is of pre-eminent moral significance. Let us call the latter the 'postulate of axiological anthropocentrism', or PAA, to distinguish it from anthropocentrism in the former sense, which we can call 'valuational anthropocentrism' (Varner 1998; pp 8, 121).

The view assumed in this paper accepts the PAA, but so too does the 'Bible' of the animal rights movement, Peter Singer's *Animal Liberation* (Singer 1990). Although Singer wrote that book for popular consumption and in it avoided endorsing any particular general theory of ethics (aside from his commitment to sentientism, the view that all and only conscious organisms have moral standing), in his professional publications he clearly and squarely endorses utilitarianism – the view that right actions and institutions maximize aggregate happiness. Although his conception of happiness is complex (and varies for animals which are capable of thinking about their own futures and those which are not), he admits that a consistent utilitarian not only can but *must* allow that experimentation would be justified under some possible circumstances. Thus, in *Practical Ethics* (Singer 1983; p 77) Singer writes:

> In the past, argument about animal experimentation has often...been put in absolutist terms: would the opponent of experimentation be prepared to let thousands die from a terrible disease that could be cured by experimenting on one animal? This is a purely hypothetical question, since experiments do not have such dramatic results, but as long as its hypothetical nature is clear, I think the question should be answered affirmatively – in other words, if one, or even a

> dozen animals had to suffer experiments in order to save thousands, I would think it right and in accordance with equal consideration of interests that they should do so. This, at any rate, is the answer a consistent utilitarian must give.

And even in *Animal Liberation* (Singer 1990; p 20) he stressed that the:

> rejection of speciesism does not imply that all lives are of equal worth...It is not arbitrary to hold that the life of a self-aware being, capable of abstract thought, of planning for the future, of complex acts of communication, and so on, is more valuable than the life of a being without these capacities.

Here Singer says, in effect, that the PAA is consistent with the rejection of speciesism, which is for him the defining feature of animal rights philosophies.

Singer's opposition to animal experimentation is not, therefore, based on a rejection of the PAA. He is sceptical of animal research, not because he differs with its defenders at the level of moral principle (they certainly endorse the PAA and they tend to defend experimentation in utilitarian terms); rather, Singer opposes experimentation because he denies that we can know with sufficient certainty that proposed experiments will, in fact, serve human beings' most vital interests. As a utilitarian, if the harms inflicted on even a large (but finite) number of animals are outweighed by the harms thus prevented to a significantly larger (often indefinitely larger) number of humans, then he can support the research in question.

Something will be said below about the general, more empirical disagreement over the likelihood of benefits accruing from various lines of research. Here it is only emphasized that an animal rights philosophy like Singer's can indeed endorse the PAA. However, not only is it consistent with Singer's utilitarianism; the PAA is also endorsed by Tom Regan's rights-based view.

Regan claims – with good reason – to be the true philosophical expositor of the animal rights movement. Moral rights are commonly thought of as – in Ronald Dworkin's memorable phrase – 'trump cards against utilitarian arguments', since if animals have rights, then we cannot adequately justify experimentation in purely utilitarian terms. Yet even Regan explicitly endorses a version of the PAA. For he endorses a principle which, coupled with the analysis of harm he endorses, implies that human lives (at least those of normal adults in their primes) have pre-eminent moral value. Here is his statement of the principle (Regan 1983; p 308), which he calls 'the worse-off principle':

> Special considerations aside, when we must decide to override the rights of the many or the rights of the few who are innocent, and when the harm faced by the few would make them worse-off than any of the many would be if any other option were chosen, then we ought to override the rights of the many.

Obviously this principle's application hinges on how the notion of being made 'worse-off' is interpreted. Regan assesses harms and, therefore, who is made 'worse-off' in relation to whom, in terms of lost opportunities for desire formation and satisfaction. This is not an implausible account of harm. In particular, it seems to capture the tragedy that death is to a normal, adult human, better than does a purely hedonistic conception of harm: assessing the harm that death is in terms of its effects on long-term, complex projects or plans makes a premature, but painless, death seem worse than assessing the harm in terms of lost opportunities for pleasure. However, the point here is only that the above principle would, in

conjunction with this conception of harm, seem to imply that experiments which cause significant harm – including death – would be justified if they indeed saved human lives. For as Regan (1983) himself admits: on his conception of harm, the harm that death is to a normal human being in the prime of his life, is non-comparably worse than the harm that death is to any non-human animal (see his discussion of 'lifeboat cases', pp 324-25). Hence, the worse-off principle would seem to apply to medical research aimed at saving human lives and it would seem to imply that some such research is justifiable.

Two questions remain from Regan's perspective. One is the same empirical question that a utilitarian like Singer faces: just how certain do the benefits need to be before we are justified in pursuing them via harmful experimentation? The other is a problem that Regan himself stresses in justifying his own, almost blanket, opposition to experimentation. Regan claims that risks are not morally transferable without consent; and since animals are incapable of giving consent, experiments that impose risks upon animals which they would not face outside the experimental milieu, cannot, in his opinion, be justified. This, he says, is a 'special consideration' which blocks the application of the worse-off principle to the case of medical experimentation (Regan 1983; p 377).

Many would disagree with Regan's assertion that risks are not morally transferable without consent. There are a range of cases where we think it justifiable to impose risks on humans without their consent (eg civilians whose country we attack in a just war), and if that is so, then there probably are a larger range of cases, including some experimentation, in which we are justified in doing so with animals. The object here is not to defend this claim, but only to indicate how a perspective just like Regan's, but without the qualification about involuntary transfers of risk, would seem to imply that some animal experimentation might be justifiable, because it recognizes the PAA.

If both Singer's and Regan's views imply the PAA, then surely it is not inaccurate to say that axiological anthropocentrism is at least consistent with an animal rights view. However, before considering such a view's application to cloning research specifically, it is necessary to discuss the moral status of embryos and foetuses.

The moral relevance of potential characteristics

Singer and Regan endorse very different criteria for moral standing. Singer holds that sentience is the key, that being able to experience pleasure and pain is a necessary and sufficient condition for having interests which matter from a moral point of view. Regan conceives of harm in terms of impacts on one's capacity to form and satisfy desires; and that is, for him, necessary and sufficient for having moral rights.

Without deciding between these competing criteria, we can ask: if a certain characteristic qualifies its possessors for some kind of moral consideration, does the (as yet unactualized) potential to later develop that characteristic qualify its possessors for similar moral consideration now?

An affirmative answer to this question appears to be at work in the ways many people think about the destruction of human and animal embryos. Media coverage suggests that many people think that significantly different moral questions arise when it is human embryos that face destruction. Cloning of embryos is now commonly used in cattle production, where an embryo of a promising breed line is divided into many copies which are frozen for future use, pending maturation of one test copy. Most people seem to have no

problem whatsoever in contemplating the destruction of many frozen clones when the test bull or cow turns out to be less desirable than anticipated. Yet when multiple human embryos have been frozen during infertility work, their destruction has aroused great controversy. Why the difference? Probably the PAA is at work here. Because the human embryos have the potential to develop into individuals whose lives and most vital interests have special moral value, their destruction seems more problematic than the destruction of cattle embryos which lack this potential. This only follows, however, if we also assume that the unactualized potential to develop a characteristic does indeed qualify its possessors for the same kind of moral consideration that is due to those who have realized this potential.

This may be a mistake, however. In day-to-day talk about the exercise of either moral or legal rights, we do not normally think that an individual has the right in question unless and until she or he actually develops whatever characteristics qualify one for the right in question. As Stanley Benn once put it (Benn 1984; p 143): 'A potential president of the United States is not on that account Commander-in-Chief'. In another essay on the abortion issue, Joel Feinberg expanded on Benn's example to argue against what he called a 'modified or gradualist potentiality criterion', according to which rights claims emerge, or gain strength gradually, as related potentials are realized (Feinberg 1984; pp 147-148):

> In 1930, when he was six years old, Jimmy Carter didn't know it, but he was a potential president of the United States. That gave him no claim *then,* not even a very weak claim, to give commands to the US Army and Navy. Franklin D Roosevelt in 1930 was only two years away from the presidency, so he was a potential president in a much stronger way (the potentiality was much less remote) than was young Jimmy. Nevertheless, he was not actually president, and he had no more of a claim to the prerogatives of the office than did Carter.

Assuming that Feinberg and Benn are correct about rights specifically, why should we treat moral considerability in general any differently? If, like Tom Regan, we believe that the capacity to form and satisfy desires is necessary and sufficient for the possession of moral rights, then we should not think that the mere potential for having desires qualifies one for any moral rights now. If, like Peter Singer, we believe that sentience is necessary and sufficient for having interests which warrant moral consideration, then we should not think that an embryo which has only the potential to become sentient therefore has morally considerable interests.

People often wonder how advocates of animal rights could consistently be pro-choice on the abortion issue, but it is possible to hold both views consistently if one denies the moral relevance of potential characteristics. For, even if one endorses the PAA and thinks that the life of a normal adult human is of pre-eminent moral value, one need not think the same of an embryo or foetus – at least before it has developed any of the characteristics that give the lives of normal adults that pre-eminent value. At what point in the course of pregnancy (or after) a human or animal develops the capacities for sentience and/or desire is a complicated question, but we can probably agree that an undifferentiated embryo lacks both.

While denying that potential alone confers intrinsic value, we can see how even an undifferentiated embryo might, under certain circumstances, have very great *instrumental* value. For instance, if all and only sentient organisms' lives have intrinsic value, then an embryo with the potential to develop sentience currently has no intrinsic value, although it now has instrumental value insofar as it could be used to produce something with intrinsic value. If there were a shortage of sentient beings, any potentially sentient embryo would be

of great instrumental value. Note, however, that if the world already has plenty of sentient beings, then the fact that an embryo can be used to produce yet another one gives it little instrumental value; and if there are already more than the optimal number of sentient beings around, then there is good reason not to let it develop. Certainly there is presently no dearth of human beings on the planet, so one can plausibly deny that a human embryo's capacity to produce a normal adult human being (who does have special moral value according to the PAA) currently gives the embryo anything like that special moral value.

An animal rights perspective on cloning

The preceding sections clarify the kind of animal rights perspective from which we now assess research on the cloning of animals. We consider such research from the perspective of views which:

i) endorse the PAA;
ii) deny that the (unactualized) potential to develop moral standing bestows moral standing; and
iii) evaluate policies either
iii a) in utilitarian terms, conceiving of harms to individuals in hedonistic terms; or
iii b) in light of Regan's worse-off principle, conceiving of harms to individuals in terms of effects on the capacity to form and satisfy desires.

Obviously, from such a perspective, one tenet of the Missyplicity Project's *Code of Bioethics* (Table 1) seems unnecessary.

Table 1 The Missyplicity Project *Code of Bioethics*

1) In accordance with Federal law, no animals will be intentionally harmed at any point during this project, including the research phase. In addition, no animals will be endangered through lack of attention to care, or by being subjected to risky procedures of any type.
2) The psychological welfare, happiness and socialization of all dogs involved with the Missyplicity Project shall be considered at all times. Every dog shall be guaranteed a daily minimum of one hour of outdoor playtime – weather permitting, indoors otherwise – with people hired specifically for this task.
3) Regardless of the source through which dogs are obtained for use as egg donors or surrogate mothers – animal shelters, breeding farms, etc – at the completion of their role on the Missyplicity Project, all dogs shall be placed in loving homes. No funds shall be expended for dogs raised under inhumane conditions, such as in 'puppy mills'.
4) The 'turnover rate' before an animal involved with the Missyplicity Project is placed in a loving home shall be limited to 8 months, with less than 6 being the goal.
5) Every effort will be taken to minimize the waste of viable embryos. Viable embryos will only be destroyed if implantation is impossible, or if the embryos are flawed and likely to result in deformities.
6) All dogs born as a result of this project shall be treated as pets, and placed in loving homes, even if they are not actual clones of Missy. In the unlikely event that a dog is born with deformities or other problems, it will only be euthanized if it is suffering, and shall otherwise be placed in a loving home.
7) No transgenic – 'gene-changing' – work of any kind shall be performed.
8) Every effort shall be taken to ensure that the technology and procedures developed for the Missyplicity Project will be applied in the future in an ethical and socially positive manner.
9) No data, personnel or other resources shall be knowingly shared with people or programs seeking to clone human beings.

Reprinted with permission of the Project Director and Author, Lou Hawthorne, from the Missyplicity Project website: http://missyplicity.com.

Tenet 5 states: 'Every effort will be taken to minimize the waste of viable embryos. Viable embryos will only be destroyed if implantation is impossible, or if the embryos are flawed and likely to result in deformities.' One of the goals of the Missyplicity Project is to develop techniques for cloning dogs whose genetic endowment gives them special value as 'service dogs', ie dogs which help the disabled, sniff out drugs, or locate survivors amid the rubble of an explosion or landslide. Trainers believe that dogs' abilities to do these things are largely genetically determined, and since the most skilled dogs can only be identified via a lengthy training process, the ability to clone those adults with demonstrated aptitude would allow trainers to produce effective dogs in larger numbers at lower cost. Another goal of the project is to allow for the cloning of members of endangered canid species. Obviously, cloning cannot by itself improve the genetic diversity of an endangered species, but where a small number of individuals remain in the wild, we could clone them without reducing them to captivity and ensure that their genetic variation is preserved through captive breeding; or we could increase genetic diversity in the wild by reintroducing clones of captive individuals which are not candidates for reintroduction, due to age, socialization to humans, or other factors.

In terms of these goals, frozen embryos can be seen to have great instrumental value, at least under certain circumstances, even if we deny that their potential characteristics confer any intrinsic value or moral standing. However, if the initial attempts at canid cloning are made on dogs which lack such special value, why should any special effort be made to bring all those viable embryos to term? As the techniques involved are perfected, we can imagine easily producing far more viable embryos than would ever be useful in, say, an endangered species breeding programme. Thus, the blanket concern about destroying embryos expressed in tenet 5 of the project's *Code* seems unwarranted – at least from the kind of animal rights perspective adopted here.

Tenets 2, 3, 4, and 6 set very high standards for dogs used in the project. Tenet 2 requires careful attention to the psychological well-being of the dogs, including guaranteeing each one a full hour of outdoor playtime every day. Tenets 3 and 4 limit their involvement in the project to a maximum of 8 months, after which they must all be placed in 'loving homes'. Tenet 6 limits euthanasia to those 'born with deformities or other problems' which actually cause suffering. There is, however, an ambiguity in these tenets. Tenets 2, 3 and 6 each refer specifically to 'dogs' involved in the project, whereas tenet 4 refers to 'animals' in general. Presumably, the Missyplicity Project will never use mice or goats, for instance, even though the researchers will probably adapt techniques that were originally developed by others working on those animals; but if animals other than dogs are ever used in the project, the question of why different standards are applied would arise.

Tenets 8 and 9 concern the project's relationship to other possible research. Tenet 9 forbids collaboration or the sharing of information with people seeking to clone humans. Tenet 8 requires that: 'Every effort shall be taken to ensure that the technology and procedures developed for the Missyplicity Project will be applied in the future in an ethical and socially responsible manner.' Does this mean sharing data and techniques only with researchers who endorse the high ethical standards of the Missyplicity Project? Given that one cannot control who learns from one's published research results, it is not clear exactly how this is could be done, but tenet 8 has potentially sweeping implications.

That leaves only tenets 7 and 1, which are implicitly interrelated. Tenet 7 forbids 'transgenic – ''gene-changing'' – work of any kind' on the project; and tenet 1 reads: '...no animals will be intentionally harmed at any point during this project, including the research

phase. In addition, no animals will be endangered through lack of attention or care, or by being subjected to risky procedures of any type.' Obviously, the notions of harming intentionally (as opposed to unintentionally), and the related notion of subjecting an individual to 'risky procedures' are crucial to understanding this tenet, and some background on the processes currently being developed to clone adult animals is necessary if we are to understand its implications.

Dolly the sheep was not newsworthy because she was a clone. For years, animals had been cloned in large numbers by repeatedly dividing early, undifferentiated embryos; but it seemed much more difficult to clone an adult – since adult cells have become differentiated by shutting down most of the genetic code necessary to produce a complete organism. When, during the summer of 1998, DNA analysis demonstrated that Dolly was indeed a clone of a 6-year-old ewe (Ashworth *et al* 1998 ; Signer *et al* 1998), and numerous mice were produced from adult cells using a variant of the procedure used to produce Dolly (Wakayama *et al* 1998), it was established that adult DNA can indeed be 'reprogrammed' to drive the development of a clone. The technique used, called 'somatic nuclear transfer cloning technology' (or 'somacloning', for short), involves removing the nucleus from an adult body cell (a somatic cell) and placing it into a blastocyst (an early, undifferentiated embryo cell) from which the original nucleus has been removed. The techniques used to produce Dolly and the somacloned mice differed in terms of which adult body cells were used for the donor nuclei (mammary cells in Dolly's case, and cumulus cells [which surround eggs in the ovaries prior to ovulation] in the case of the mice); in terms of the techniques used to insert the donor nuclei; and in terms of how and for how long the resulting diploid cells were maintained in a quiescent condition before cell division was reactivated. The reprogramming process is thought to occur during the period of quiescence, although no one yet understands how this happens (Solter 1998).

When Dolly's existence was made public, although she was by all appearances very healthy, media reports and popular discussions frequently implied that somaclones might face some new kind or level of risk. It was widely emphasized that it had taken hundreds of attempts using the new technology to produce just this one somaclone, and rumours circulated in popular discussions that many somaclones were born grossly deformed. The latter rumours probably resulted from confusion of this case with the celebrated 'Beltsville Pigs' experiment. (In 1985, the USDA's Beltsville experimental station in Maryland successfully micro-injected the piece of human DNA coding for human growth hormone into the nuclei of fertilized pig eggs. Of the 19 transgenic swine which survived to maturity, many had serious health problems, including deformed bodies, ulcers, arthritis, and decreased immune functions.) People who confused cloning, which doesn't alter the base DNA, with genetic engineering, which does, would think that cloning is likely to produce monsters.

Such confusions aside, the fact that it took hundreds of applications of the new technology to produce one somaclone could raise legitimate concerns about the risks facing somaclones, given the still mysterious nature of the DNA reprogramming process. What if it turned out that something about the process made it likely that somaclones would be born deformed or otherwise unhealthy – for instance because the reprogramming process tended to be incomplete and leave important genes unexpressed? A closer look at the data from the project that produced Dolly (Wilmut *et al* 1997) assuages such fears, especially in light of the subsequent results involving somacloned mice.

Although Wilmut's team made upwards of 300 attempts to fuse nuclei from adult cells with de-nucleated blastocysts, they only transferred 29 into host mothers, and these resulted

in only one pregnancy: Dolly. They simultaneously applied the same technique to clone animals using nuclei from foetal and embryonic cells, however, so the total numbers are worth mentioning. A total of 834 attempts were made to fuse donor nuclei and de-nucleated blastocysts, but only 156 were ever transferred into surrogate mothers, resulting in at most 21 pregnancies. On the kind of view assumed here, it is difficult to see any moral problem in disposing of 678 blastocysts, or in the 135 transferred embryos which failed to result in pregnancies. Surely all those undifferentiated embryos which never resulted in pregnancies never developed the capacity for either sentience or desire, and hence were incapable of being harmed in any morally relevant way by either Singer's or Regan's criteria. Since we are assuming that potential does not confer the same status as actualized characteristics or capacities, these cells' potential to develop sentience or desire gave them no moral standing at the time of their destruction.

What of the 21 pregnancies? Eight live births resulted, suggesting a rate of foetal loss dramatically higher than that reported after natural mating (62% vs 6%, respectively; Wilmut *et al* [1997]). Note, however, that Wilmut and co-workers based the figure of 21 pregnancies on ultrasound scans performed at only 7–8.5 weeks, or about one-third of the way into a 21-week pregnancy. (They first scanned 'on day 50–60 after oestrus' and the normal gestational period for domestic sheep is around 150 days.) Also, that they noted 'fewer foetuses were observed' on subsequent scans conducted at 2-week intervals, 'suggesting either misdiagnosis or foetal loss' (Wilmut *et al* 1997; p 811).

Wilmut *et al* (1997) do not give figures for how many diagnosed pregnancies remained at subsequent scans, so not only is it hard to say exactly how many foetuses were lost, it is also hard to say exactly when the loses occurred. This is not the place for an extended discussion of when in the course of pregnancy (or after) the capacities for sentience and for conscious desire develop (some of the relevant considerations are discussed in Varner [1998; Chapter 2] and in DeGrazia [1997; Chapters 5 and 6]), but it is, at least, not obviously true that many of the miscarried individuals would have developed either sentience or the capacity for desire by the time they died.

Of the eight lambs born, one died within minutes of birth, but this peri-natal loss rate of 12.5 per cent is 'not dissimilar to that occurring in a large study of commercial sheep, when 8 per cent of lambs died within 24h of birth' and 'post-mortem analysis failed to find any abnormality or infection' in the one lamb (Wilmut *et al* 1997; p 811). The other six surviving lambs, all appear to be normal, and Dolly has since 'undergone two normal pregnancies and has successfully delivered healthy lambs' (Shiels *et al* 1999; p 317).

Mice cloned subsequently using similar techniques have successfully mated, delivered and then reared healthy offspring, suggesting that somaclones are indeed quite normal, although the ratio of implantations to live births was similarly low and peri-natal losses similarly high (however, the normal peri-natal loss rate for the specific strain of laboratory mice used was not given). In August 1998 Wakayama *et al* announced that they had produced 22 healthy adult somaclones, including seven 'second generation' somaclones (somaclones of somaclones), but it took 1385 embryo transfers to produce 31 live births with peri-natal losses of 41.2 per cent, 16.7 per cent and 12.5 per cent across three subject populations.

Still, there is reason to be concerned that health problems will yet emerge as these somaclones age. At 1 year, Dolly's telomeres were found to be significantly shorter than those of 1-year-old sheep cloned from embryonic and fibroblastic nuclei (Shiels *et al* 1999). Although the process and significance of telomere shortening is not fully understood, it is suspected that aging may, somehow, be tied to it.

The term, 'telomere' refers to DNA at the ends of the chromosomes, which, although not coding for any genes, protects that coded information from being lost in the process of cell division. Telomeres mark the ends of chromosomes with may repetitions of simple DNA patterns, but due to the way in which DNA synthesis is primed in eukaryotic organisms several base pairs of DNA are lost from one or other end of the chromosome at each cell division (Zakian 1995). Cellular mechanisms for telomere repair exist. In particular, germ cells in older, normal adults do not have shortened telomeres – the sheep clones with which Dolly was compared appeared to have started from scratch, as it were. Nevertheless, many researchers suspect that organismic senescence arises as important coded information is lost from somatic cells, when their telomeres become too short.

The lifespan of laboratory mice is relatively short, so it is encouraging that the Wakayama team's 'second generation' somaclones matured normally. Discussing Dolly's telomeres, Shiels *et al* (1999; p 317) note that there is a 'large size distribution' of telomeres in sheep – so it 'remains to be seen whether a critical length will be reached during [Dolly's] lifetime'. However, it is too early to rule out concerns about telomere shortening. The best that can be said as this paper went to press (September 1999), is that the jury are still out on the significance of telomere shortening in somaclones.

Nevertheless, the work of the Wilmut and Wakayama teams to date gives the Missyplicity Project team reason to believe that somacloning dogs will work – and produce normal, healthy adults. Setting aside public fears and rumours, the first actual somaclones have not been horribly deformed monsters. This is why tenet 7 is implicitly related to tenet 1 in the project's *Code of Bioethics*. However, the same cannot be said of genetic engineering. Precisely because 'gene-splicing' in mammals alters a highly evolved and highly integrated genetic code, there was reason, a priori, to think it might produce unhealthy abnormalities.

Wilmut and co-workers could not have been certain that the first somaclone to result in a pregnancy would be healthy; nor did Dolly's turning out healthy prove that the Wakayama team's mice would be normal. Since no one understood (nor does anyone yet understand) the mechanism by which DNA is reprogrammed during somacloning, neither team of researchers could have been certain, a priori, that somaclones would not turn out unhealthy. So the question arises: could the Wilmut and Wakayama teams have proceeded with their work if they had been operating under the Missyplicity Project's *Code of Bioethics*?

The answer to this question hinges on a deeper one: how, in general, are we to decide what risks to experimental subjects are worth running? As we saw above, both Singer's and Regan's animal rights views endorse a version of the PAA, and thus for both, at least some experimentation will be justified if it promises to safeguard humans' most vital interests. Somacloning applied to humans promises great benefits indeed. Yet how certain must be the benefits and by how much must they outweigh the harms to experimental subjects? Although it is now almost certain that we will be able to somaclone whole humans, opening up new reproductive alternatives for infertile couples, what may be the greatest benefits of the technology will require much better understanding of the DNA reprogramming process. For instance, if enough can be learned about control of gene expression, somacloning could be used to produce extensive skin, muscle, and bone for rejection-free grafts, and possibly even more complex organs or components of organs. However, these more stunning results are hardly a certainty at present when the entire DNA reprogramming process remains a mystery.

Outside the context of actually proposed research and research that has already been conducted, there probably is no way to answer the question of how certain the benefits of a

line of research must be to justify harming research subjects in the process. For better or worse, it is only within the context of a body informed about both previous medical advances and the details of currently proposed research that this judgement call can be made – that is, something like the Institutional Animal Care and Use Committee (IACUC) structure mandated by the USA's *Animal Welfare Act*. Something like an IACUC is the only viable way to make ethical decisions about publicly funded research involving animals.

However, there is reason to be sceptical of existing IACUCs; reason to doubt that these committees reject research nearly as often as they should. Texas A&M's own IACUC, for instance, has only once in its history refused authorization to an experimental protocol on the grounds that the experiment was not worth performing (personal communication between author and members of the Committee). The laity are justifiably sceptical of this kind of percentage approval rate, even when the IACUC frequently (or almost always) calls for revisions in submitted protocols (as Texas A&M's IACUC does). Committees operating under US law mostly assume that their mission does not include judging the worthiness of proposed research, which they presume has already been done by the agencies which fund it. However, the mandate of IACUCs could be amended to authorize this judgment call, and greater representation of lay people and non-scientists on the committees could be required. The author includes himself among the laity on matters scientific and, although he has some sympathies with the animal rights movement, considers that if you can't convince a generally reasonable and fair-minded individual – especially a staunch adherent of the PAA – that your research is worth the cost in harm and lives (or risk of the same) to your experimental subjects, then perhaps you should think twice about proceeding with it. Common sense is not always unreasonable, and if lay people were closer to constituting a majority of IACUC representation, rather than – as they almost always are now – a tiny minority, such reconsideration might occur more often.

General discussion and animal welfare implications

Although funded by a couple interested in cloning their favourite companion animal, the Missyplicity Project has more important collateral goals and is in addition part of a general line of research which, if successful, promises enormous clinical benefits to humans. Such benefits to humans are directly relevant to a moral assessment of the programme from the type of animal rights perspective adopted in this paper.

In addition to developing a low-cost, commercial dog-cloning service for the general public, an important collateral result would be the ability to clone service dogs. These include guide dogs and emergency rescue dogs, which contribute significantly to the well-being of disabled or trapped and injured individuals. According to the PAA, only human beings have certain interests, or a kind of value, which is of pre-eminent moral significance. Without specifying what these interests or this value are (see Varner [1998; Chapter 4] for one account), we can be pretty certain that guide and rescue dogs at least sometimes contribute significantly to them, either by saving lives in rescue situations, or by giving the disabled greater opportunities. Since services dogs' abilities are strongly genetically influenced, developing the ability to clone good service dogs could immediately contribute in significant ways to the lives of many humans by making good service dogs more readily and cheaply available.

A less direct spin-off of the Missyplicity Project involves possible clinical benefits to humans, and, in principle, to dogs and other animals. Although the Missyplicity Project will not, by itself, unravel the mystery of how DNA is reprogrammed, this project is part of a large line of research that may, one day, make possible clonal production of tissues like skin, muscle and bone, which can be grafted onto injured individuals with no threat of rejection and hence no need for related drugs. It might even be possible eventually to produce whole organs or components of organs. Obviously such clinical applications could be applied in veterinary contexts too, although this is less likely if the techniques remain very expensive.

Are any direct benefits to animals likely to come out of the Missyplicity Project? One small but very tangible benefit is to the dogs acquired for use in the project, which experience nothing more invasive and debilitating than a pregnancy or a spaying and get a lot in the bargain.

Although tenet 3 mentions the possibility of obtaining dogs from animal shelters, various current regulations make this impractical – and consequently all dogs are being purchased from commercial breeders of research subjects. However, as a result of being used in this project, these dogs are assured of living very good lives. The project's *Code of Bioethics* guarantees each dog at least an hour of outdoor play with a staff member each day (tenet 2), limits their participation in the project to 8 months (tenet 4), and requires that they be placed 'in loving homes' at the end of their stay (tenet 3). Although it would have been nice to be able to say that all the dogs used in the project were being rescued from shelters, from the perspective of the animals purchased from research farms, the Missyplicity Project is indeed a godsend – even if they are incapable of appreciating their good fortune.

For the dogs acquired for use in the project, their selection for the Missyplicity Project ensures that they begin the journey from being a research animal to being a companion animal. At what cost this journey? While in the project, the dogs serve either as surrogate mothers, and thus undergo artificial egg implantation and pregnancy; or they serve as egg donors, in which case they undergo a form of surgery similar to spaying. With some other species it has been possible to aspirate immature eggs from the ovaries laparoscopically and mature them in vitro. With dogs, however, this is still impossible – immature eggs must be allowed to ovulate and spend 48h in the oviduct before they can be fertilized. Consequently, the Missyplicity Project team has to flush ovulated eggs from the oviduct. This requires general anaesthesia and an abdominal incision equivalent to that used for spaying. The eggs are flushed by penetrating both ends of the oviduct with needles and these puncture wounds heal without stitches. As all dogs used in the project are spayed before being placed as pets, the additional surgery the egg donors undergo is no more invasive than the spaying they all experience – and this is in turn no more invasive and dangerous a procedure than companion animals routinely undergo.

Although the notion of benefiting a breed or a species is more philosophically problematic than the notion of benefiting individual animals as just discussed, the project also promises to have significant spin-off 'benefits' at this level. One of the most difficult choices facing endangered species breeding programmes is deciding whether and when to take free-ranging individuals into captivity for breeding purposes. When remaining genetic diversity is critically low, it is sometimes deemed necessary to capture the last remaining wild individuals in order to increase the captive breeding pool. With canid somacloning perfected, this would be unnecessary. *Every* genotype remaining in the wild could be incorporated into a captive breeding programme by merely taking biopsies and raising the resulting clones in captivity, leaving the original carriers of the genotypes in the wild. Conversely, reintroducing

a unique individual into the wild risks losing that genotype from the breeding pool forever, a risk which somacloning could eliminate.

Assuming that the embryos used in somacloning research which never develop their potential for sentience or desire have no moral standing, the Missyplicity Project looks very good indeed from the perspective of the research subjects themselves. Since it seems very likely to be of direct benefit to humans who rely in important ways on service dogs as well as for the management of endangered canids, and as it appears that it might contribute, in at least some small way, to dramatic advances in clinical medicine, the Missyplicity Project also appears completely justifiable from an animal rights perspective of the variety adopted here. Indeed, it is hard to see how anyone could oppose this specific project from anything short of a total abolitionist perspective on animal research.

More generally, the results of the Wilmut and Wakayama studies suggest that even from an animal rights perspective, research on somacloning does not pose new or special moral problems. Given the enormous, potential clinical benefits, even an animal rights perspective (at least one that endorses the PAA and denies the moral relevance of merely potential characteristics) could endorse this general line of research.

Acknowledgements

This paper began as an invited presentation at a one-day seminar on animal engineering – construed to include cloning in addition to genetic engineering – sponsored by the University of Pennsylvania's Bioethics Center and College of Veterinary Medicine in March 1998. I would like to thank the organizer, Dr James Serpell, for including me in the programme, and thus prodding me into thinking about cloning.

References

Ashworth D, Bishop M, Campbell K, Colman A, Kind A, Schnieke A, Blott S, Griffin H, Haley C, McWhir J and Wilmut I 1998 DNA microsatellite analysis of Dolly. *Nature 394:* 329

Benn S I 1984 Abortion, infanticide, and respect for persons. In: Feinberg J (ed) *The Problem of Abortion* pp 135-44. Wadsworth Publishing: Belmont, California, USA

DeGrazia D 1996 *Taking Animals Seriously: Animals and Why They Matter.* Cambridge University Press: Cambridge, UK

Feinberg J 1984 Potentiality, development, and rights. In: Feinberg J (ed) *The Problem of Abortion* pp 145-50. Wadsworth Publishing: Belmont, California, USA

Missyplicity Project *Code of Bioethics.* http://missyplicity.com

Regan T 1983 *The Case For Animal Rights.* University of California Press: Berkeley, California, USA

Shiels P G, Kind A J, Keith H S, Campbell D W, Wilmut I, Colman A and Schnieke A E 1999 Analysis of telomere lengths in cloned sheep. *Nature 399:* 316-17

Signer E N, Dubrova Y E, Jeffreys A J, Wilde C, Finch L M B, Wells M and Peaker M 1998 DNA Fingerprinting Dolly. *Nature 394:* 329-30

Singer P 1990 *Animal Liberation, revised edition.* Avon Books: New York, USA

Singer P 1993 *Practical Ethics.* Cambridge University Press: Cambridge, UK

Solter D 1998 Dolly *is* a clone – and no longer alone. *Nature 394:* 315-16

Varner G E 1998 *In Nature's Interests? Interests, Animal Rights, and Environmental Ethics.* Oxford University Press: New York, USA

Wakayama T, Perry A C F, Zuccotti P M, Johnson K R and Yanagimachi R 1998 Full-term development of mice from enucleated oocytes injected with cumulus cell nuclei. *Nature 394:* 369-74

Wilmut I, Schnieke A E, McWhir J, Kind A J and Campbell K H S 1997 Viable offspring derived from foetal and adult mammalian cells. *Nature 385:* 810-13

Zakian V 1995 Telomeres: beginning to understand the end. *Science 270:* 1601-07