Human Reproductive Cloning and Related Techniques: An Overview of the Legal Environment and Practitioner Attitudes

A. KATAYAMA¹

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Purpose: This study provides an overview of the legal environment and assisted reproductive technology (ART) practitioner attitudes toward human reproductive cloning.

Methods: A review of the law and a survey of ART practitioners and a comparison group of attorneys were undertaken.

Results: Human reproductive cloning has been prohibited in many countries, and may soon be prohibited in others. However, many ART practitioners support its use for limited indications.

Conclusions: ART practitioners were surveyed concerning their views on human reproductive cloning and related techniques. A few had considered using or had used embryo splitting or germ cell nuclear transfer. Although they expressed some concerns about the present risk of reproductive cloning, most indicated that it did not violate their religious beliefs. More than three-quarters of ART practitioners responding indicated that they would be willing to provide human reproductive cloning in indicated cases if it were legally permissible to do so. A significant percentage of the group also indicated that they currently have the ability to provide this service.

KEY WORDS: embryo splitting; germ cell nuclear transfer; legal issues; practitioner attitudes; reproductive cloning.

INTRODUCTION

Since Dolly appeared on the scene in Scotland in 1997, there has been much discussion and some action on the subject of human reproductive cloning. Unfortunately, the distinctions between reproductive cloning and related but fundamentally different techniques are often lost. The purpose of this study was

to assess how the distinctions among human reproductive cloning and related techniques are being handled in the legislative arena and how they might affect the attitudes of two admittedly select groups: assisted reproductive technology (ART) practitioners around the world and attorneys in the United States.

MATERIALS AND METHODS

Human Reproductive Cloning and Related Techniques

Human reproductive cloning (HRC) is a term which should be confined to somatic cell nuclear transfer (SCNT), i.e., the transfer of the DNA of a human somatic cell to an enucleated human oocyte, the fusing of the somatic cell nucleus to the ooplasm and the activation of cell division, followed by embryo transfer for gestation. Two other techniques which are often confused with HRC are embryo splitting (ES) and germ cell nuclear transfer (GCNT).

ES, also called blastomere splitting or blastomere separation, refers to dividing an early stage in vitro created human embryo into two or more parts and allowing each to continue developing for subsequent embryo transfer. GCNT, also called ooplasm exchange, refers to using the ooplasm from a donor oocyte, combined with the nucleus of the patient's oocyte, to be followed by in vitro fertilization and embryo transfer to the patient or her gestational surrogate. The discussion is further complicated by the fact that HRC/SCNT has extensive uses in addition to the possible creation of human offspring. Most of the scientific organizations opposed to HRC are at the same time in support of research on embryonic stem cells, which shows great therapeutic potential.

¹ Quarles & Brady L.L.P., 411 East Wisconsin Avenue, Milwaukee, Wisconsin 53202-4497; e-mail: ack@quarles.com

Legislative Activity

This study is not by any means a comprehensive survey of all United States or international laws which may touch upon reproductive cloning and related techniques. Rather, it is a brief overview of those laws intended to provide ART practitioners with a sense of what is happening around the world.

Many organizations have called for a legislative ban on HRC. In the United States, these include the Council for Responsible Genetics, Resolve (an infertility patient advocacy group), the American Medical Association, and the National Bioethics Advisory Committee (NBAC). The NBAC called for legislation to make SCNT a federal crime when done for the purpose of creating a child. NBAC expressed concern about the safety of the resulting children due to the risks of physical, psychological, and social harm from being created through SCNT (1).

Internationally, opposition to HRC has been widespread. The leaders of the G-8 countries (Russia, Italy, Japan, the United States, Great Britain, Canada, Germany, and France) at a 1998 summit, and Ian Wilmut, the creator of Dolly, have registered their opposition to HRC. The World Health Organization of the United Nations and the Canadian Royal Commission on Reproductive and Genetic Technologies have also called for a ban on HRC. In the view of the United Nations, "practices which are contrary to human dignity, such as reproductive cloning of human beings, shall not be permitted." The United Nations has also expressed the view that "other germ line interventions" could be contrary to human dignity although there is no specification of what was meant by "other germ line interventions." At the same time, however, the Universal Declaration notes that freedom of research is part of freedom of thought (2).

The Council of Europe has adopted a protocol which prohibits "any intervention seeking to create a human...genetically identical to another human (3)..." Twenty-five of the 41 member states of the Council of Europe have signed this protocol. However, it does not come into force under the Council's procedures until it is ratified by five countries. So far only four have ratified it. It should be noted that although Germany did not sign the protocol, German law would already prohibit HRC.

At least 21 countries have laws prohibiting HRC, according to a 1999 survey conducted by the American Society for Reproductive Medicine in cooperation with the International Federation of Fertility Societies (4). Like all laws, however, these laws are

open to interpretation. There is some debate even among individuals from the countries reported as prohibiting HRC as to whether HRC and/or GCNT are actually prohibited by these laws. Other states, including Canada, Egypt, Ireland, and Israel, have guidelines which prohibit HRC but have not yet enacted legislation to that effect. Belgium, Finland, Greece, Hong Kong, India, and Portugal appeared to be without either guidelines or laws prohibiting HRC at the time of the 1999 IFFS/ASRM survey. More recently, Japan, Columbia, and Britain have taken action in this area.²

Various professional societies have announced self-imposed bans on HRC. These include the American Society for Reproductive Medicine (ASRM), the Federation of American Societies of Experimental Biology, the U.S. Biotechnology Industry Organization, and the European Society for Human Reproduction and Embryology. At the same time, these scientific organizations support SCNT for nonreproductive purposes. Few organizations, however, are distinguishing between HRC/SCNT on the one hand and similar techniques on the other hand. ASRM is one of the few which has made a distinction here. ASRM has stated that the use of HRC/SCNT does not meet standards of ethical acceptability at this time (5). However, ASRM has gone on record as not being opposed to ES in certain situations (6).

So far in the United States, four states have passed laws attempting to deal with HRC/SCNT (7).³ The variable impact of these laws on related techniques is presented in Table I. In some cases, the prohibition on SCNT distinguishes one purpose from another. For example, Michigan prohibits the creation of a human

² Japan's law prohibits creating human embryos by inserting a somatic cell into an unfertilized enucleated egg and transferring it to a human uterus. Violators are subject to fines and prison sentences. The law permits limited research on cloned human embryos. The Columbian law, passed on July 24, 2000, prohibits manipulating human DNA other than for the purpose of treatment, diagnosis, or scientific investigation intended to alleviate suffering or improve the health of any person. (599 Laws of 2000, Book 2, Title I, Chap. 8, Art. 132.) Britain's recent action in this arena amends its Human Fertilization and Embryology Act of 1990, effective January 22, 2001. Limited cloning for research on stem cells from human embryos will now be allowed but "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" is still prohibited. (United Kingdom Statute 1990 c37s3.)

³ See also Mo. Stat. Ann. § 1.217 (West 2000). Missouri does not prohibit performance of HRC, but prohibits the use of state funds for research with respect to the cloning of a human person, defined as the replication of a human person by taking a cell with genetic material and cultivating such cell through the egg, embryo, fetal, and newborn stages of development into a new human person.

Table I. U.S. State Law Prohibitions

	ES	GCNT	SCNT
California		X	X
Michigan			X
Rhode Island	X		X
Louisiana		X	X

Note. X indicates technique is prohibited

embryo without regard to whether the intent is to implant it. On the other hand, Rhode Island prohibits SCNT when it is for the purpose of initiating a human pregnancy. Most of these laws do have sunset provisions to bring them to an end in 5 years. Bills to prohibit SCNT and, in some cases, related techniques, are pending in some 30 states.

In some states which have not yet acted specifically to prohibit HRC/SCNT, there are preexisting statutes banning or regulating experiments on embryos, conceptuses, unborn children, or the like (8). Statutes which use the term “embryo” would not prohibit HRC/SCNT because in HRC the experimental step involves the manipulation of the egg, not the embryo. These statutes do however create uncertainty with regard to HRC.

An analysis of the language from California’s anticlone statute illustrates the breadth of many of the prohibitions being enacted in this area (“Transfer of the nucleus from a human cell from whatever source into a human egg cell from which the nucleus has been removed for the purpose of initiating a pregnancy...”). The prohibition on transferring a nucleus “from whatever source” would ban not only HRC, which uses a somatic cell, but also GCNT, where a nucleus is taken from human egg cells.

It has been suggested that the nuclear transfer technique could be used to create a genetically biparental child. This technique could be used when one or both members of the couple did not have germ cells (9). (For such couples today, the only options are gamete or embryo donation.) This approach would involve generating haploid cells by taking diploid adult somatic cells and inducing them in vitro to undergo meiotic reduction to produce haploid cells. The nuclei from these cells generated from a male and female partner could then be used to create a fertilized egg cell, provided that the ooplasm from a donor oocyte can be made available. This approach would involve the transfer of a nucleus from each of the parents’ cells and would thus run afoul of a statute modeled on that in California.

The federal legislative approach to the possibility of HRC in the United States has constituted a debate between two camps. Many bills have been introduced. Representative bills in the first camp are those introduced by Senator Diane Feinstein, which would allow SCNT to clone molecules, DNA, and cells and tissues, and encourage gene therapy, but prohibit the transfer of a cloned embryo (i.e. the product of SCNT) to a human uterus (10). This approach is supported by biotech and pharmaceutical companies. It essentially maintains that cloned embryos are not human—that they can be used for experiments and therapy but never implanted. The second approach exemplified in legislation introduced by Senators Christopher Bond and Trent Lott would not expressly ban pregnancy or live birth but would totally prohibit the use of SCNT and criminalize that activity (11).

Attitudes Toward HRC and Related Techniques

In order to assess the attitudes of ART practitioners toward HRC and related techniques, a survey was conducted. The ART practitioners surveyed were all members of the Association of Private Assisted Reproductive Technology Clinics and Laboratories, (A-PART), a relatively new professional society of international membership. For comparison purposes, a random sample of United States attorneys drawn from the alumni directories of two law schools was also surveyed.⁴ Practitioners and attorneys were given a virtually identical set of definitions of HRC, GCNT, and ES and virtually identical questions. The survey forms are reproduced in the Appendix. Sixty percent of the ART practitioners receiving the survey responded, as did 24.5% of the attorneys.

Characteristics of ART Practitioners Surveyed

The ART practitioners (mostly MDs with a few PhD embryologists) spanned the religious spectrum being approximately 16% Protestant, 20% Catholic, and 7% Jewish, with 20% professing other religions (Muslim, Hindu, Buddhist) and 20% claiming to be atheist or not declaring any religion. More than half of the practitioners were involved in programs located in Europe, 10% came from the United States, 12% from the Middle East, and the balance from other parts of the world. More than half of the ART practitioners

⁴ The University of Michigan School of Law and the University of Maryland School of Law were selected for this survey.

surveyed are located in cities with populations between 1 and 6 million while 20% are located in cities with population over 6 million. Two-thirds of the responding ART practitioners work with programs doing 1,000 or fewer cycles per year while only 10% work with programs doing more than 2,000 cycles per year. The responding practitioners were about evenly divided between those over the age of 50 and those under the age of 50.

RESULTS

Practitioners were asked about research and clinical use of ES and GCNT. Although embryo splitting has been a possibility for many years, only 8% of the respondents had ever used it for clinical purposes. Ten percent of respondents reported using GCNT for clinical purposes and over 20% are considering such use (Table II).

Most of the survey questions were directed at assessing attitudes toward HRC. Nearly 75% of the practitioners indicated that HRC was sometimes appropriate, while only 38.5% of the attorneys felt that way. Similarly, 61.5% of the attorneys responding said HRC was never appropriate, while only 25.5% of the practitioners responded in that fashion (Fig. 1).

Among those respondents who indicated that HRC was appropriate, the survey attempted to discern what specific indications were regarded as appropriate. While over half of the attorneys who thought that HRC was appropriate considered it to be indicated for any infertile couple, only 17% of the practitioners responded that way. The top three indications for HRC among ART practitioners were the following: the only option for a couple to have a child genetically related to one member of the couple; assisting a couple where one partner has a serious genetic disorder; and assisting a couple where both partners are carriers of a recessive genetic disorder. These latter options came in second, third, and fourth (with coincidentally identical scores) among the attorneys responding to the survey (Fig. 2).

Table II. Techniques Considered or Used by ART Practitioners (%)

	ES	GCNT
Considered for research	6.3	6.3
Considered for clinical	18.8	20.8
Used for research	0	4.2
Used for clinical	8.3	10.4

Fig. 1. When is HRC appropriate.

Respondents were asked about their concerns regarding HRC. The most frequently cited concern among practitioners was the low success rate in animals, followed by fear that the clone might have an advanced genetic age. The lack of sharing of male/female genetic material as in normal reproduction came in third in the list of concerns. The unacceptably high risk of congenital defects in the clone and the transformation of children into commodities tied for fourth place. Among attorneys, however, the commodification of children was the number one concern, followed by an affront to human dignity. The lack of sharing of male and female genetic materials was in third place. Risk of congenital defects in the clone also came in fourth with the attorneys, followed by the low success rate in animals (which had been the practitioners' number one concern) (Fig. 3).

Respondents were also asked whether HRC violated their religious beliefs. The response was analyzed only for those who claimed to profess a religion. Among religious attorneys, nearly 36% claimed that HRC would violate their religious beliefs. However,

Fig. 2. Ranking of indications for HRC: ART practitioner and attorney views.

only 13.5% of the practitioners identifying themselves as religious reported that HRC violated their religious beliefs (Fig. 4).

ART practitioners were asked to assume that HRC was legal in their country. A total of 76.9% of the practitioners who indicated that reproductive cloning was appropriate in some circumstances indicated that they would be willing to provide the service if it were legal in their country to do so. More than 36% indicated a belief that they are currently able to provide this service (Table III).

In an effort to determine whether wording can make a difference, the attorneys were divided into two groups (based on school of graduation) at the outset of the survey. Both groups were given the same definition of GCNT. In the first group, the term, “germ cell nuclear transfer” was attached to that definition, whereas in the second group the term “ooplasm donation” was attached to the definition. Each group of attorneys was asked whether they regarded the defined technique as a reasonable one which should be permitted versus whether the technique sounded like cloning and should be regulated or prohibited

in the same fashion as cloning. Sixty two and one half percent of attorneys queried on GCNT found it reasonable, while 80% of the attorneys queried regarding ooplasm donation found that technique to be reasonable. Although the sample size was too small for this difference to be statistically significant, it trends in that direction. A larger sample might have shown that, at least in the legal community, words do matter.

All respondents were also asked whether they considered ES and GCNT acceptable in some circumstances. Oddly enough, far more of the attorneys found ES and GCNT acceptable than did practitioners, while the reverse was true for cloning (Table IV).

DISCUSSION

A review of the laws enacted and pending in the United States indicates that HRC and related techniques are “hot topics.” The risk that overbroad wording may limit budding infertility treatment techniques which are not HRC appears to be very real.

Fig. 3. Frequently cited concerns regarding HRC: ART practitioners vs. attorneys.

Fig. 4. HRC violates religious beliefs of some.

Since attorneys tend to be the lawmakers in the United States and in many other countries, it may be important to consider how attorneys think about these things. Attorneys in this survey seemed to find ooplasm donation more acceptable than GCNT. This study suggests a possibility that the way in which these techniques are presented to lawmakers can influence the outcome of the legislative process. If lawyers are influenced by wording, it is also possible that wording matters in the court of public opinion.

Table III. Provision of HRC Services by ART Practitioners

Willing to provide	76.9%
Currently able to provide	36.6%

Table IV. Techniques Acceptable in Some Circumstances (%)

	ART Practitioners	Attorneys
ES	25.0	44.3
GCNT	27.1	68.5
RC	76.9	38.5

Fear of the unknown tends to produce a ban, whereas the more that people know about a topic, the less they fear it, and the more likely they are to engage in a thoughtful approach to it. It appears that there is some attorney support for ES and GCNT and even minority attorney support for limited uses of HRC. Explaining the distinctions between HRC and related techniques like ES and GCNT and identifying appropriate but clearly limited indications for HRC may help to avoid overbroad regulation.

A top practitioner concern regarding HRC is the current low success rate in animals. This was also a significant concern for attorneys. This is likely to change. Karl Ilmensee has suggested that the combination of GCNT with ES (at the four cell stage) may lead to significant improvements in the success rate of HRC. Such improvement may increase the acceptability of HRC.

No prohibition has yet been passed in the United States at the federal level and if one does, it may be subject to challenge. The right to make decisions concerning reproductive health matters is well established in the United States as a constitutional right and it can be argued that the use of reproductive cloning is part of the established right to reproduce as and when one sees fit. Regulation of a fundamental right must have a compelling reason if it is to be permissible and must be narrowly tailored to achieve government objectives. On the other hand, it has been argued that HRC is not procreation at all, but replication, since it does not involve combining male and female gametes and that it therefore may be subjected to regulations for less than compelling reasons. Arguably GCNT is procreation in the traditional sense, not replication, and therefore one should be able to make a stronger case for a constitutionally protected right to use this technique.

If overbroad prohibitions are enacted, they may be challenged. Part of the panoply of reproductive rights established in the United States is the right to choose abortion. Over the past 30 years, this right has become firmly entrenched as part of the concept of reproductive freedom and procreative liberty. Women in many other countries also enjoy a statutory, if not a constitutional right to abortion. The lack

of concern for the fetus which must accompany the right to abortion may well have laid part of the foundation for acceptance of IVF and other forms of ART, since these techniques pose some risk (although an ever-decreasing one as technology improves) to the embryo.

This very same diminished concern for the fetus may have provided at least part of the foundation for the recent acceptability in the United States, Britain, and elsewhere, of the use of cells derived from embryos for research on human pluripotent stem cells. Will the same diminished concern, together with the right to abortion, create the basis for legitimizing human cloning? Or, to put it another way, if an individual who caused an IVF embryo to be created can consent to its destruction for research, then might not the same individual arguably also have a right to give an artificially created cloned embryo a chance to live by consenting to its implantation with the intention of creating a pregnancy.

Although an increasing number of countries have laws or guidelines prohibiting HRC, there may always continue to be countries where it is not regulated. This fact, coupled with the willingness of practitioners and the claimed expertise found in this survey, suggest it may be only a matter of time before HRC is actually carried out.

APPENDIX: SURVEY OF A-PART MEMBERS

A. Definition of Terms Used in Survey

Embryo splitting (also called blastomere splitting or blastomere separation) refers to dividing an early stage in vitro created embryo into two or more parts and allowing each to continue developing for subsequent embryo transfer.

Germ cell nuclear transfer (also called ooplasm exchange) refers to using the ooplasm from a donor oocyte, combined with the nucleus of a patient's oocyte, to be followed by in vitro fertilization and embryo transfer to the patient or her gestational surrogate.

Human reproductive cloning refers to the cloning of a human being by somatic cell nuclear transfer, i.e., the transfer of the DNA of a human somatic cell to an enucleated human oocyte, fusing of the nucleus to the ooplasm, and activation of cell division, followed by embryo transfer for gestation.

Research procedure refers to a procedure undertaken as a pilot using surplus human gametes/embryos, without a plan to provide an immediate therapeutic benefit to a specific patient.

B. Scope of Survey: This survey does not deal with nonreproductive cloning, i.e., the derivation (from human embryos or human fetal tissue) and use of human pluripotent stem cells for purposes other than the creation of a human embryo.

For purposes of answering this survey, please set aside your knowledge and concerns relating to the legal situation in your country. This survey solicits your personal views based on your personal values.

I. Embryo Splitting

- a. Has your program considered undertaking embryo splitting in humans?
 - ☐ No
 - ☐ Yes, but only as a research procedure
 - ☐ Yes, for clinical application
- b. Has your program used embryo splitting in humans?
 - ☐ No
 - ☐ Yes, but only as a research procedure; If so, how many times _____
 - ☐ Yes, for clinical application; If so, how many times _____
- c. Describe the results of any research or clinical applications (cite publication if any):
 - _____
 - _____
 - _____
 - _____
- d. If your program does not use, or does not intend to use, please give reasons:
 - _____
 - _____
 - _____

II. Germ Cell Nuclear Transfer

- a. Has your program considered undertaking germ cell nuclear transfer in humans?
 - ☐ No
 - ☐ Yes, but only as a research procedure
 - ☐ Yes, for clinical application

- b. Has your program used germ cell nuclear transfer?
 ___ No
 ___ Yes, but only as a research procedure; If so, how many times ____
 ___ Yes, for clinical application; If so, how many times ____
- c. Describe the results of any research or clinical activity mentioned above (cite publication, if any): _____

- d. If your program does not use, or does not intend to use, germ cell nuclear transfer, please give reasons: _____

III. Reproductive Cloning

- a. Many reasons have been cited in opposition to cloning. Do you agree with any of the following reasons not to perform this procedure:

Human reproductive cloning should not be performed because	Agree	Disagree	Agree, but this could change in the future
It currently has such a low success rate in animals (approximately 1 out of 100 to 300 attempts)			
The risk of genetic defects in the clone is too great			
It eliminates the need for a family unit			
It will hinder the evolutionary process			
It violates my religious beliefs			
It violates the natural goal of reproduction namely, the sharing of genetic material from a man and a woman			
With an advanced genetic age the clone may face the risk of a shorter lifespan			
It makes children seem like a manufactured commodity			

- b. For purposes of answering these questions, please assume that you are living in a time and place where legal impediments to reproductive cloning in humans have been removed.

I would regard reproductive cloning as appropriate in the following circumstances (mark all that apply):

- ___ no circumstances (skip to Section IV)
 ___ any infertile couple
 ___ advanced maternal age
 ___ only option for couple (e.g. azospermia) to have offspring entirely related to one parent
 ___ gay patient couple
 ___ lesbian patient couple
 ___ to copy child of patient couple whose only child is dying
 ___ to copy child of patient couple with several children, one of whom is dying
 ___ your favorite aunt or uncle is single, past reproductive age, has no heirs, and desires a child
 ___ patient couple where one partner is afflicted with a genetic disorder
 ___ patient couple both of whom are carriers of a recessive genetic disorder
 ___ unmarried individual with no child
 ___ to provide a backup supply of organs/tissue for your patient's young child
 ___ other: _____

- c. Other comments you wish to add:
- d. In the circumstances you identified above, as being appropriate for the use of reproductive cloning, would your program be willing to provide this service? ___Yes ___No
- e. Do you now have the resources to attempt reproductive cloning? ___Yes ___No

IV. Characteristics of person completing this survey:

- a. Age: ___20–30; ___31–40; ___41–50; ___over 50
 b. Highest degree completed/field:
 c. Position/Title:
 d. Religion:

V. Characteristics of program in which you work:

- a. Located in what country?
- b. Population of city?
- c. Size of program (IVF cycles per year)
- d. How is patient treatment funded?
 Government payment _____
 Private insurance payment _____
 Self-pay _____
 Other _____
- e. Is program hospital-based? ____Yes
 ____No

VI. Name (optional) _____

REFERENCES

1. National Bioethics Advisory Commission: Cloning human beings: Report and Recommendations of the National Bioethics Advisory Commission. National Bioethics Advisory Commission, Rockville, MD, June 1997
2. 1998 Universal Declaration on the Human Genome and Human Rights, U.N. GAOR Res. 68, 29th Sess., U.N. Doc. 29 C/21 (1997)
3. Council of Europe, Draft Additional Protocol to the Convention on Human Rights and Biomedicine on the Prohibition of Cloning Human Beings, 34 I.L.M. 1515 (1997)
4. Jones HW, Cohen J, Out HJ, IFFS Surveillance 98. *Fertil Steril* 1999;71:28s-29s
5. The Ethics Committee of the American Society for Reproductive Medicine: Human somatic cell nuclear transfer (cloning). *Fertil Steril* 2000;74:873-876
6. ASRM Ethics Committee Statement adopted by ASRM Board of Directors Dec 8, 1995
7. Mich. Comp. Laws Ann. §§s 333.16274 and 750.430a (West 2000); La. Rev. Stat. §§s 1299.36-1299.36.6 (West 2000); R.I. Gen. Laws §§s 23-16.4 - 1 to 23-16.4 - 4 (West 2000); Cal. Health & Safety Code §§s 24185 - 24189 (West 2000); Cal. Bus & Prof Code §§s 2260.5, 16105 and 16004 (West 2000)
8. Fla. Stat. Ann. § 390.0111(6) (West 2000); La. Stat. Ann. 9:121 *et seq.* (West 2000); Me. Rev. Stat. Ann. tit. 22, § 1593 (West 2000); Mass. Gen. Laws Ann. ch. 112, § 12J (West 2000); Mich. Comp. Laws Ann. § 333.2685 *et seq.* (West 2000); Minn. Stat. Ann. § 145.421 (West 2000); N.D. Cent. Code § 14-02.2-01 (1991); N.H. Rev. Stat. Ann. § 168-B:15 (West 2000); 18 Pa. C.S.A. § 3216 (West 2000); R.I. Gen. Laws § 11-54-1 (West 2000)
9. Johnson MH, Kubiak JZ: Legal confusion over cloning risks: Throwing baby out with bathwater. *Nature* 2000;407: 559
10. S. 1602 and S. 1611, 105th Cong., 2d Sess (1998)
11. S. 1599 and S. 1601, 105th Cong., 2d Sess (1998)