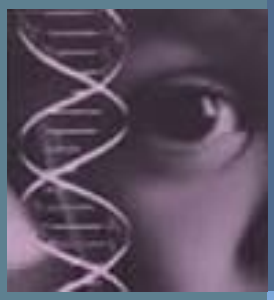

Is There an Emerging International Consensus On the Proper Uses Of the New Human Genetic Technologies?

Testimony of Richard Hayes, Ph.D.
Executive Director, Center for Genetics and Society

House Foreign Affairs Committee
Subcommittee on Terrorism, Nonproliferation and Trade

19 June 2008

On June 19, 2008, the U.S. House of Representatives Foreign Affairs Committee Subcommittee on Terrorism, Nonproliferation and Trade held a hearing on *Genetics and Other Human Modification Technologies: Sensible International Regulations or a New Kind of Arms Race?* The hearing was called by subcommittee chair Congressman Brad Sherman (D-Los Angeles).

Testifying were:

Jamie F. Metzl, Ph.D., Executive Vice-President, The Asia Society

Richard Hayes, Ph.D., Executive Director, Center for Genetics and Society

Nigel M. de S. Cameron, Ph.D., President, Center for Policy on Emerging Technologies

Paul R. Billings, M.D., Ph.D., President and CEO, Cellpoint Diagnostics, Inc.

Texts of submitted testimonies and transcripts of the hearing proceedings are available at http://foreignaffairs.house.gov/sub_terrorism.asp.

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Mr. Chairman and members of the Committee:

Thank you for inviting me to discuss what I and many others believe is one of the most urgent topics on the world agenda today: the need for international agreements concerning the proper uses of the new human biotechnologies.

My name is Richard Hayes and I am executive director of the Center for Genetics and Society. CGS is a public affairs institute working in support of the socially responsible governance of the new human biotechnologies. We work at state, national and international levels with scholars, scientists, legal experts and leaders in the fields of human rights, civil rights, women's health, social and economic justice and the environment.

I've been asked to address the question, "Is there an emerging international consensus on the proper uses of the new human genetic technologies?" While countries differ widely concerning many aspects of the policies they have adopted, I believe that in regard to the most seriously consequential of these technologies, the answer is "Yes."

I want to begin with introductory comments, review genetic technologies and practices of special concern, highlight areas around which consensus appears to be developing, and conclude with some observations on the challenges we face in translating that consensus into formal policy.

I. Introduction

The new human biotechnologies have the potential for both great good and great harm. If they are developed and used responsibly and in accordance with commitments to human rights and social justice they could lead to medical advances and improved health outcomes. If misused they could exacerbate existing health disparities and lay the basis for new forms of discrimination and inequality. They could open the door to new eugenic practices and ideologies that would undermine the foundations of civil society and indeed our common humanity. In combination with emerging technologies such as nanotechnology, neurotechnology and synthetic biology, they could put agents of unprecedented lethal force in the hands of both state and non-state actors.

If the benefits of these technologies are to be realized and the dangers avoided, effective regulatory oversight and control will be needed at both national and international levels. Many countries have already adopted comprehensive national policies of the sort needed, but most have not adopted any policies at all, and international agreements are few and partial. International initiatives that would encourage individual countries to adopt best practices, and that would draw needed lines and address cross-border, trade and technology transfer issues, are long overdue.

II. Technologies and Practices of Special Concern

There are scores, if not hundreds, of new human biotechnologies and practices, but I'm going to focus on a subset widely recognized as being of particular consequence. These are new technologies that have the potential to alter the nature of human nature and society at the most fundamental levels. I'll focus further on ones that are currently practicable or could become so in the near future, and thus might be of particular concern to policymakers and the public.

The technologies that I'll address fall into three general categories: human genetic modification, human genetic trait selection, and human cloning. An outline of these is shown in **Attachment A.**

Human genetic *modification* means manipulating and changing the genes in living human cells. Human genetic *trait selection* means selecting eggs, sperm or embryos that possess genes associated with particular traits, without actually modifying those genes. Human *cloning* means the creation of either human embryos or full term human children that are genetically identical to previously existing human beings, whether living or dead.

Let's first consider human genetic modification. A convenient device for considering types of human genetic modification and their societal implications is the box shown in **Section I** of Attachment A.

Human genetic modification has been proposed for both "therapeutic" and "enhancement" purposes. "Therapeutic" purposes are those that return a person suffering from an illness or deficiency to a condition of health or wholeness. "Enhancement" purposes go beyond considerations of normal health and seek to make a person "better than well." Some applications of human genetic modification appear to fall into a gray area between "therapy" and "enhancement," but for most applications this distinction is reasonably clear.[1]

Human genetic modification can be applied at two levels, called *somatic* and *germline*.[2] Somatic modifications are those that change genes in the cells of a person's body *other than* their sperm or egg cells, and thus do not make changes that are inheritable. Germline modifications change the genes in a person's egg or sperm cells, and are thus passed on to all succeeding generations.

Together, these aspects of human genetic modification define four types of applications: "somatic therapy, "somatic enhancement," "germline therapy," and "germline enhancement."

Somatic therapy is commonly known as "gene therapy." Examples of somatic therapy include attempts to cure cystic fibrosis or severe combined immunodeficiency disease ("bubble boy" disease), by inserting healthy genes into lung tissues or bone marrow cells to correct dysfunctional genes. Clinical gene therapy trials have been underway since the early 1990's.

Examples of somatic enhancement might involve inserting genes into the muscle or lung tissues of athletes to increase their strength or respiratory capacity. At the present time such interventions have not been attempted in humans.

Examples of germline therapy might involve inserting healthy genes into an early-stage embryo that is found to contain the genes causing cystic fibrosis or bubble boy disease. Such interventions have not been attempted, but the techniques that would enable these are under development.

Examples of germline enhancement might involve modifying the muscle or lung-cell genes of an early-stage embryo in an attempt to generate increased muscular strength or respiratory capacity in the child that that embryo gives rise to. Germline enhancement has also been seriously proposed as a means of creating people with such novel cognitive, psychological, and behavioral traits that they would constitute a new, "post-human" species, incapable of interbreeding with "normal" humans.

Next, let's consider human genetic *trait selection,* noted in **Section II** of Attachment A. This process doesn't actually modify the genes in any human cells. Rather, it involves determining which genes are carried in particular eggs, sperm and early embryos, and using only those which carrying preferred genes to create a child.

Human genetic trait selection can be used for medically-related purposes or for non-medical or "social" purposes.

An example of medically-related genetic selection would be testing a set of single-cell zygotes created via IVF

procedures for the genes that cause cystic fibrosis or Tay-Sachs, and only using zygotes free of those genes to initiate a pregnancy. Such medically-related genetic trait selection – commonly referred to as "preimplantation genetic diagnosis", or PGD – is available in many countries, although use is still limited. In cases where there is a risk of passing on a sex-linked disease such as Duchenne muscular dystrophy, PGD can be used to ensure that the child born will be of the sex that does not have or carry the disease.

An example of social genetic selection would be testing embryos created using IVF procedures to ensure that one's child is a boy or a girl, independent of any evidence of risk of a sex-linked disease.

Trait selection can't be used for novel *enhancement* purposes, because it involves selecting from genes that span the normal range of human genetic variation. And it is unclear to what extent it can be used to select for most social traits, given that these typically depend upon a multitude of genes. For technical reasons it is difficult to select embryos for more than one or two genes at a time.

It's important to note that the "medical/social" distinction, like the "therapy/enhancement" distinction, can in some instances be ambiguous or subject to interpretation. Many people with disabilities, for example, don't believe that their conditions are medical ones that need to be prevented or cured. Policies on human genetic technology will need to take such concerns into account.

Finally, we come to the topic of human cloning, noted in **Section III** of Attachment A. Once more, there are two different applications of cloning technology. *Research cloning* refers to the process of creating a clonal human embryo for experimental purposes.[3] *Reproductive cloning* also involves creation of a clonal human embryo, but rather than being used for experimental purposes it would be implanted in a woman's womb, gestated and brought to term as a born child.

Attachment A doesn't include embryonic stem cell research, because such research does not *per se* involve the modification or selection of particular human genes. However, some forms of embryonic stem cell research involve research cloning.[4]

A Broad Assessment

The benefits and risks that the new human genetic technologies entail have been debated for well over a quarter century. Rather than attempt a summary of that complex debate here, I'd like to offer what I believe is a fair assessment of where there appear to be rough areas of general agreement among experts, policymakers, and the general public, both domestically and internationally, and where it is clear there is disagreement. After that I'll review the policies that have been adopted in particular countries and by intergovernmental bodies.

I believe it's fair to make the following generalizations:

- The development and use of ***somatic therapy*** is widely considered to be acceptable. Positive results to date have been sparse, but recent experimental treatments for leukemia and retinal eye disease have offered new encouragement.

- ***Germline enhancement*** is widely considered to be unacceptable. It serves no compelling medical purpose, could generate new and deep forms of inequality, gives individuals in one generation new and profound power over the life conditions of individuals in another without their consent, and could change the nature of human nature and society in unpredictable ways.

- ***Somatic enhancement*** is widely considered to be highly problematic. It serves no compelling medical purpose, and could introduce new forms of inequality. It is less consequential that germline enhancement because at least in the first instance it only affects a single individual and consent would be easy to obtain. But its impact on the nature of human values and social relationships could be profound.

- ***Germline therapy*** at first appears to be a difficult call. Most people strongly support therapeutic applications of genetic science, but they also realize that the manipulation of inheritable genetic traits crosses a consequential barrier. In the great majority of instances, couples at risk of passing on a serious genetic disease can ensure that their child is disease-free by means of medically-related trait selection, thus

obviating the need for the far more complex and risk-prone intervention that germline modification would entail.

- ***Human genetic trait selection*** is generally supported if it is used to allow a couple at risk of passing on a serious genetically-based illness to their child a chance to avoid doing so. However, it is generally opposed for non-medical or "social" purposes, such as ensuring that the child is of a desired sex.

- ***Human reproductive cloning*** is almost universally rejected. It serves no justifiable purpose and poses profound societal risks.

- The use of ***cloning for research purposes*** has become a divisive issue, in the United States and other countries, with many strongly supportive and others strongly opposed. Research cloning has become especially contentious because it has been seen as a key element in some forms of stem cell research. However, recently developed procedures that allow derivation of cells similar to embryonic stem cells from normal body cells may reduce or eliminate the utility of using clonal human embryos to derive stem cells.[5]

- ***Embryonic stem cell research*** using embryos created in the course of *in vitro* fertilization procedures, but left unused, is generally although cautiously supported. Many who oppose abortion typically oppose such research, although not always.

With this background, what can we say about the policy response to date on the part of individual countries around the world, and by intergovernmental bodies?

III. Policies

A. Policies in Countries Around the World

Summaries of policies for key technologies and practices are shown in **Table 1** and **Table 2**. Full tables, including definitions of the policy categories used, are shown in **Attachments B** and **C.** A table showing data for embryonic stem cell research is shown in **Attachment D**.

TABLE 1. All countries (192 total)

	Number of countries in which the practice is explicitly:	
Practice	***Prohibited***	***Allowed***
Reproductive cloning	59	0
Germline modification	44	0
Social trait selection	36	0
Research cloning	40	14
Embryonic SCR using IVF embryos	12	44
Medically-related trait selection	6	30

Among those countries that have adopted policies addressing these practices, reproductive cloning, germline modification, and social trait selection have been unanimously prohibited. Of countries that have adopted policies on research cloning, the majority have prohibited it, but this position is by no means unanimous, as 14 countries have explicitly sanctioned it. Opinion is also divided regarding embryonic stem cell research using embryos previously created in the course of fertility treatments, although far more allow it than prohibit it. Medically-related trait selection is widely sanctioned, although several countries prohibit it. Data on policies addressing somatic enhancement have not yet been compiled.

Additional insight can be had by reviewing the status of policies in the thirty member countries of the Organization for Economic Cooperation and Development (OECD). These countries account for nearly one-fifth of the world's population and fully 84% of world GDP, and support the most fully developed human biotechnology research sectors. They include many European countries, but also include non-European countries such as Japan, Korea, Turkey, Mexico, Canada, Australia, and the United States. Table 2 shows that 97% of OECD countries have

banned reproductive cloning, 88% have banned germline modification, and 77% have banned genetic screening for non-medical purposes. None have explicitly approved any of these. Those few OECD countries that don't yet have formal policies addressing all three of these practices, such as Ireland, Poland and Mexico, appear likely to oppose them.

A majority of OECD countries have also banned research cloning, although 27% have explicitly sanctioned this practice. Strong majorities have approved embryonic stem cell research using IVF embryos, as well as medically-related trait selection, although several countries have prohibited both of these. Data for all 30 OECD countries is shown in **Attachment E.**

TABLE 2. OECD countries (30 member countries)

	Percent of countries in which the practice is explicitly:	
Practice	***Prohibited***	***Allowed***
Reproductive cloning	97%	0
Germline modification	83%	0
Social trait selection	77%	0
Research cloning	63%	27%
Embryonic SCR using IVF embryos	13%	73%
Medically-related trait selection	10%	67%

B. Policies Adopted by Intergovernmental Organizations

What policies have been adopted or promoted by major intergovernmental organizations? I review key organizations in turn.

1. The United Nations

In 2001 France and Germany proposed a binding UN treaty calling for a prohibition on human reproductive cloning. An early procedural vote suggested unanimous support for this measure. A significant number of countries subsequently expressed opposition to banning reproductive cloning without simultaneously banning research cloning. This led to extended controversy, and the debate became, essentially, a debate over the acceptability of research cloning. By 2003 it became clear that a consensus concerning research cloning could not be achieved. In 2005 a non-binding declaration opposing both research cloning and reproductive cloning was brought to a vote. It received a plurality of votes (46%), which under UN rules makes it the official UN position. Both opponents and supporters of research cloning claimed vindication of their positions. Supporters of research cloning noted that as the declaration was non-binding, and as 18% of UN member states supported research cloning, the vote was of questionable significance. Opponents of research cloning noted that a larger number of countries had expressed strong opposition to research cloning than had initially been anticipated.[6]

2. UNESCO

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) Bioethics Programme is led by the International Bioethics Committee (IBC), consisting of 36 outside experts, and the Intergovernmental Bioethics Committee (IGBC), consisting of representatives from 36 member states. The Bioethics Programme has sponsored three major nonbinding international agreements:[7]

* The ***Universal Declaration on the Human Genome and Human Rights*** was adopted unanimously by the UNESCO General Conference in 1997 and ratified by the UN General Assembly in 1998. The Declaration calls for member states to undertake specific actions, such as the prohibition of "practices which are contrary to human dignity, such as reproductive cloning of human beings." It also calls on the IBC to study "practices that could be contrary to human dignity, such as germline interventions."
* The ***International Declaration on Human Genetic Data*** was adopted in 2003. The declaration is intended "to ensure the respect of human dignity and protection of human rights and fundamental freedoms in the collection, processing, use and storage of human genetic and proteomic data, and of the biological samples from which they are derived, in keeping with the requirements of equality, justice and solidarity, while giving due consideration to freedom of thought and expression, including freedom of research."
* The ***Universal Declaration on Bioethics and Human Rights*** was adopted in 2005. The Declaration used a human rights framework to establish normative principles in fifteen areas, including human dignity and

human rights; equality, justice and equity; and protecting future generations. These principles cover a wider range of issues than the previous two bioethics Declarations.

UNESCO took the lead in negotiating the International Convention Against Doping in Sports, in collaboration with the World Anti-Doping Agency (WADA), which had earlier been established by the International Olympic Committee. It includes language banning the use of genetic technology to enhance athletic performance in official athletic events, referred to as "gene-doping." The Convention entered into force on February 1st, 2007, and has been ratified by 86 countries (not including the United States). More are expected to sign prior to the Beijing Olympics in August.[8] The earlier Copenhagen Declaration on Anti-Doping in Sport has been signed by 192 countries, including the United States.[9]

3. Council of Europe

The 47-member Council of Europe maintains a Bioethics Division, guided by a Steering Committee on Bioethics. The Council's Convention on Biomedicine and Human Rights was opened for signatures in 1997 and went into force in 1998. As of March 2008 it has been signed or ratified by 34 countries. It explicitly prohibits inheritable genetic modification, somatic genetic modification for enhancement purposes, social sex selection, and the creation of human embryos solely for research purposes. A summary of key articles of the Convention is shown in **Attachment F.** The Convention is perhaps the single most well-developed intergovernmental agreement extant addressing the new human biotechnologies. Human reproductive cloning was banned by an Additional Protocol on the Prohibition of Cloning Human Beings, which went into force in 1998.[10]

4. European Union

With 27 member states, the European Union (EU) and its constituent bodies play a major and growing role in European policy integration. Article 3 of the EU's Charter of Fundamental Rights, entitled "Rights to the Integrity of the Person," prohibits human reproductive cloning, "eugenic practices, in particular those aiming at the selection of persons," and "making the human body and its parts as such a source of financial gain."[11]

5. African Union

At its 1996 Assembly of Heads of State, the African Union (then called the Organization of African Unity) approved a Resolution on Bioethics that affirmed "… the inviolability of the human body and the genetic heritage of the human species" and called for "supervision of research facilities to obviate selective eugenic by-products, particularly those relating to sex considerations."[12]

6. World Health Organization

In 1997 the WHO called for a global ban on human reproductive cloning.[13] In 1999 a *Consultation on Ethical Issues in Genetics, Cloning and Biotechnology* was held to help assess future directions for the WHO. The draft guidelines prepared as part of this consultation, *Medical Genetics and Biotechnology: Implications for Public Health*, called for a global ban on inheritable genetic modification. In 2000 WHO Director-General Gro Harlem Brundtland reiterated opposition to human reproductive cloning.[14] In September 2001 the WHO convened a meeting to review and assess "recent technical developments in medically assisted procreation and their ethical and social implications." The review covered, among other items, preimplantation genetic diagnosis, intracytoplasmic sperm injection (ICSI), and cryopreservation of gametes and embryos. In February 2002 the WHO repeated its opposition to human reproductive cloning and cautioned against banning cloning techniques for medical research. In October 2002 the WHO established a Department of Ethics, Equity, Trade and Human Rights to coordinate activities addressing bioethical issues.[15]

7. Group of Eight

At its June 1997 summit in Denver, Colorado, the G-8 called for a worldwide ban on human reproductive cloning. According to the Final Communique of the Denver Summit of the Eight, the leaders of the G-8 nations agreed "on the need for appropriate domestic measures and close international cooperation to prohibit the use of somatic cell nuclear transfer to create a child."[16]

C. Assessment

What conclusions can we draw from this brief review of policies adopted by individual countries and by intergovernmental organizations?

I believe this review strongly suggests that there is an emerging consensus among governments and intergovernmental organizations for the prohibition of human reproductive cloning, inheritable genetic modification, and social trait selection. It also suggests that opinion is divided concerning the acceptability of research cloning, and is supportive of both embryonic stem cell research using IVF embryos, and medically-related genetic trait selection.

The review also suggests that there is concern about somatic genetic enhancement, as stated in the Council of Europe's *Convention on Biomedicine and Human Rights* and by the strong positive response to the UNESCO/WADA initiative calling for bans on the use of genetic enhancement in athletic competitions. This set of practices hasn't yet received the level of public and policymaker attention that some of the other practices have, however, and has only infrequently or indirectly been addressed in national policies.

There are very likely a significant number of procedural, administrative and governance rules and guidelines around which consensus or near-consensus exists or might be attained fairly easily. These would help ensure safety, efficacy, transparency, inclusion and accountability regarding practices involving the new human genetic technologies. Such rules and guidelines are addressed, for example, in the UNESCO declarations, various sections of the Council of Europe's *Convention,* and policy advisories issued by the World Health Organization.

There also appears to be significant support for policies that would guard against the commercialization and commodification of human reproductive practices. This is seen in the prohibitions that many countries impose on payment for women's eggs for research or assisted reproduction, for similar prohibitions on commercial surrogacy, and the various conventions and policy declarations promulgated by UNESCO, the Council of Europe, and the European Union.

I want to mention here one other set of issues that falls outside the domain of human genetic engineering *per se* but is certainly related and might well fall within the jurisdiction of this subcommittee, and about which I believe a strong consensus can be established: the issue of international trafficking in human genetic and other biological materials. Organ trafficking in kidneys and other organs is growing, and often puts the largely poor donors at risk of their lives. Reports of "egg trafficking," in which eggs are extracted from women in poor countries and traded across borders for commercial gain, are increasing. "Reproductive globalization," in which pregnancy itself is "outsourced" to gestational surrogates in the global South, is also on the increase. The lack of effective controls on such potentially exploitative and harmful cross-border practices should be of great concern.

I also want to note that while I believe consensus around a core set of critical issues is developing or could easily be encouraged to develop, this is no cause for complacency. The fact that 59 countries have banned human reproductive cloning, for example, and that none have authorized it, may be taken as an encouraging sign, but the same statistic makes clear that 133 countries still lack any legal prohibitions on that practice. The same applies for other practices widely judged to be unacceptable. In the past rogue scientists have flaunted their intention to establish human cloning clinics in one or another of these countries.

D. Policy instruments

Assuming that broad areas of consensus exist or can be reached concerning the proper use of the new human genetic technologies, it will still be necessary to translate these into formal agreements, codes, protocols, treaties and the like. What might these look like?

At a conference held in 2001 at Boston University, experts in the field of international law suggested ways in which the 1997 Ottawa Treaty on the prohibition of anti-personnel landmines, and other treaties, might serve as models for international agreements addressing the new human genetic technologies.[17]

A 2002 proposal by legal scholars George Annas, Lori Andrews and Rosario Isasi called for an international "Convention on the Preservation of the Human Species" that would prohibit human reproductive cloning and inheritable

genetic modification, and mandate the establishment of national systems of oversight ensuring that the use of human gametes or embryos for experimental or clinical practices met informed consent, safety and ethical standards.[18]

In 2007 scholars associated with the United Nations University argued that the notion of a straightforward ban on human reproductive cloning had attained or had nearly attained the status of customary international law, and that measures to formalize this, perhaps negotiated under the auspices of the UNESCO International Bioethics Committee, would stand a good chance of success.[19]

Most recently, Jamie Metzl proposed a "Genetic Heritage Safeguard Treaty" (GHST) modeled on the 1970 Nuclear Nonproliferation Treaty. He argued that such a treaty could serve the dual function of both encouraging responsible applications of human genetic research and specifying limits on those applications deemed undesirable.[20]

There are other possibilities as well. The Council of Europe's *Convention on Biomedicine and Human Rights* allows countries other than Council members to ratify it, suggesting that well-crafted regional agreements might serve as foundations for global agreements.[21] Alternatively, independently negotiated regional agreements might seek to harmonize those provisions that affect humanity as a whole, while allowing other provisions to vary in accordance with regional social or cultural differences.

A productive next step might be to have a high-level task force representing the full range of constituencies with major stakes in these issues undertake a comprehensive review and assessment of options for global oversight and regulation.

However, the best designed policy instruments will be of little value if the expressed desire for such policies is thin or strongly divided. What can we say about the current state of the politics of the new human genetic technologies?

IV. Politics: Challenges, Choices and Leadership

The new human genetic technologies are a case study of what economists, political scientists and game-theoreticians call the *prisoner's dilemma* or the *collective action problem,* and what environmentalists have called the *tragedy of the commons.* Situations frequently arise in which the choices any of us might make as individuals, can, if chosen by everyone, generate negative consequences that everyone regrets.

A parent might fantasize that it would be gratifying to have a child who is an athletic superstar, perhaps through genetic enhancement, but on reflection conclude that they would not want their child to live in a world in which such genetic enhancement, building at a constantly accelerating pace, had become the norm. If enough parents shared this concern, they could collectively agree to forego the possibility of genetic enhancement. In large societies such agreements are codified and enforced through laws and regulations. Indeed, the existence of such collective action problems is the reason that governments exist in the first place. There is no inherent reason to expect that democratic governments will not be able to address collective action problems posed by the new human genetic technologies.

It's true, however, that these technologies pose special challenges. They are very new, and neither the general public nor policymakers have had the occasion to fully consider what is happening and what is at stake. The trade-offs between acceptable and unacceptable uses are clear in many instances but not in others, and people are understandably reluctant to forego possible benefits without good reason.

It was noted earlier that some applications of genetic technology fall into definitional gray areas. If it were possible to use germline engineering to create a child with immunity to all major diseases, would this constitute "therapy" or "enhancement?" Using genetic technology to allow a child lacking a key growth hormone gene to grow to normal height might be considered therapeutic, but what about allowing children with normal hormone functioning, but who are nonetheless very short, to use genetic technology to similarly grow to normal height?

Some have argued that the fact that it is difficult to draw bright lines regarding the therapy/enhancement distinction means that no lines *can* be drawn. But this is a specious argument. Public policy is in large part a matter of drawing lines; we do it all the time. Putting our trust in commercial markets and the free play of human desire would unleash a genetic enhancement rat-race that could never be contained. The responsible alternative is to establish as a matter of law the clearest lines possible and a clear statement of intent, and delegate decisions over remaining gray areas – which typically impact fewer individuals - to accountable regulatory bodies. Such structures have been put in place in the United Kingdom, Canada, France and many other countries. A summary of Canada's policies and governance structures is shown in **Attachment G**.

Another challenge is the fact that some policies will need to be universal, or nearly so, if they are to be meaningful at all. It does little good if the great majority of the world's countries agree to ban human reproductive cloning while a handful decide to distinguish themselves as free havens for the creation of human clones. If these countries are small this may be a small problem and resolvable through diplomacy, but if they are large this would be a large problem. In this regard it is worth noting that neither Russia nor the United States have yet banned human reproductive cloning.

We also need to acknowledge that in a world still far from having overcome our readiness to resort to xenophobia and armed conflict, the possibility of a techno-eugenic arms raced driven by nationalist fervor cannot be dismissed. In 2000 concern about massively lethal applications motivated computer scientist Bill Joy to call for a permanent halt to particular avenues of genetic research.[22] In 2003 the Sunshine Project documented nearly a dozen possible uses of genetic science for biowarfare purposes, including the creation of ethnicity-specific pathogens.[23] In November 2006 Kofi Annan, in one of his final addresses as UN Secretary-General, urgently called for new international treaties guarding against the development and use of genetically-enhanced bioweapons.[24] We have been moderately – but only moderately – successfully in containing the spread of nuclear, chemical and conventional biological weapons. We now need to add bioweaponry incorporating human genetic technology to our arms control portfolio.

Given the stark nature of the potential threats posed by the new human genetic technologies, why has more attention not been paid to addressing them? One reason is that in many countries, including the United States, the debate over policy concerning the new human biotechnologies has become enmeshed in the political dynamics of the culture wars. Religious conservatives were the first to become vocal on high-profile issues such as human cloning, and the debate over the new human genetic technologies was quickly framed within the conventional categories of abortion politics. In response, many liberals assumed that the progressive response was therefore one of largely uncritical support. The result has been a stalemate and a policy vacuum at the federal level and hastily conceived human biotechnology funding programs at the state levels. At the international level the result has been avoidance and neglect.

However, opinion surveys repeatedly show broad support for what might be called a principled middle-ground position concerning the new human genetic technologies. The majority of people – in America and much of the rest of the world - do not necessarily oppose all research involving human embryos, but they strongly reject reproductive cloning and the engineering or selecting of the social traits of future generations.[25]

The issues raised by the new human genetic technologies transcend conventional ideological divides. Many pro-choice women's health advocates oppose new genetic and reproductive technologies that put women's health and well-being at risk and raise concerns about the commodification of reproduction and human relationships. Human and civil rights leaders are wary of a new free-market eugenics that could stoke the fires of racial and ethnic hatred. Disability rights leaders charge that a society obsessed with genetic perfection could come to regard the disabled as mistakes that should have been prevented. Many environmentalists see human genetic modification as another hubristic technology being promoted with little regard for long-range consequences.[26]

It is likewise misleading to use the conventional categories of "left/right" or "liberal/conservative" to categorize the responses of different countries to human biotechnology concerns. Western European countries widely regarded as bastions of secular liberalism have adopted some of the strictest regulations over human genetic technology in the

world. This derives from their generally social democratic political culture, and from their first-hand experience in the 20th century with eugenics, euthanasia and the Holocaust. Europeans know all too well what can happen when ideologies and policies that valorize the creation of "genetically superior" human beings come to the fore. For different but related reasons, developing countries such as South Africa, Vietnam, India and Brazil have likewise adopted policies of social oversight and control.

Despite many statements to the contrary, the genie is *not* out of the bottle. In any event some of the genies are *good* genies, and the *worst* genies are still *in* the bottle. I sincerely believe we have the time and the capability to get ahead of the curve and do the right thing. But it will require committed engagement on the part of social and political leaders, socially responsible scientists, representatives of the world's major religious traditions, opinion leaders, public intellectuals and the press, and, finally, the general public, if we are to adopt responsible policies ensuring that the new human genetic technologies are used to improve the human condition rather than jeopardize it.

Thank you again for your interest in these vital issues.

Acknowledgements

Jesse Reynolds, Pete Shanks and Jamie Brooks assisted in the collection of the data shown in the attachments and in the preparation of this testimony.

FOOTNOTES

1 I discus the distinction between therapy and enhancement further in Section IV.

2 *Somatic* derives from the Greek *soma,* meaning "body". *Germline* refers to the germinal or seed cells, i.e., the eggs and sperm.

3 Research cloning is otherwise known as *somatic cell nuclear transfer* (SCNT). A clonal embryo results when the nucleus of a somatic cell (e.g., a skin or muscle cell) is transferred into a female egg from which the genetic material has been removed.

4 The Center for Genetics and Society supports embryonic stem cell research and public funding of it, and does not oppose the use of cloning for research purposes if carefully regulated. At the same time we believe that the highly polarized public debate over these topics has led many supporters to overstate the benefits that the use of cloning techniques might offer, and to underplay its risks and limitations. These latter include the large number of women's eggs required, the fact that it opens the door to human reproductive cloning and inheritable genetic modification, and that it is costly.

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8 UNESCO, "International Convention against Doping in Sport 2005," http://portal.unesco.org/en/ev.php-URL_ID=31037&URL_DO=DO_TOPIC&URL_SECTION=201.html

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16 *Final Communique of the Denver Summit of the Eight*, June 22, 1997; available at http://www.g7.utoronto.ca/summit/1997denver/g8final.htm

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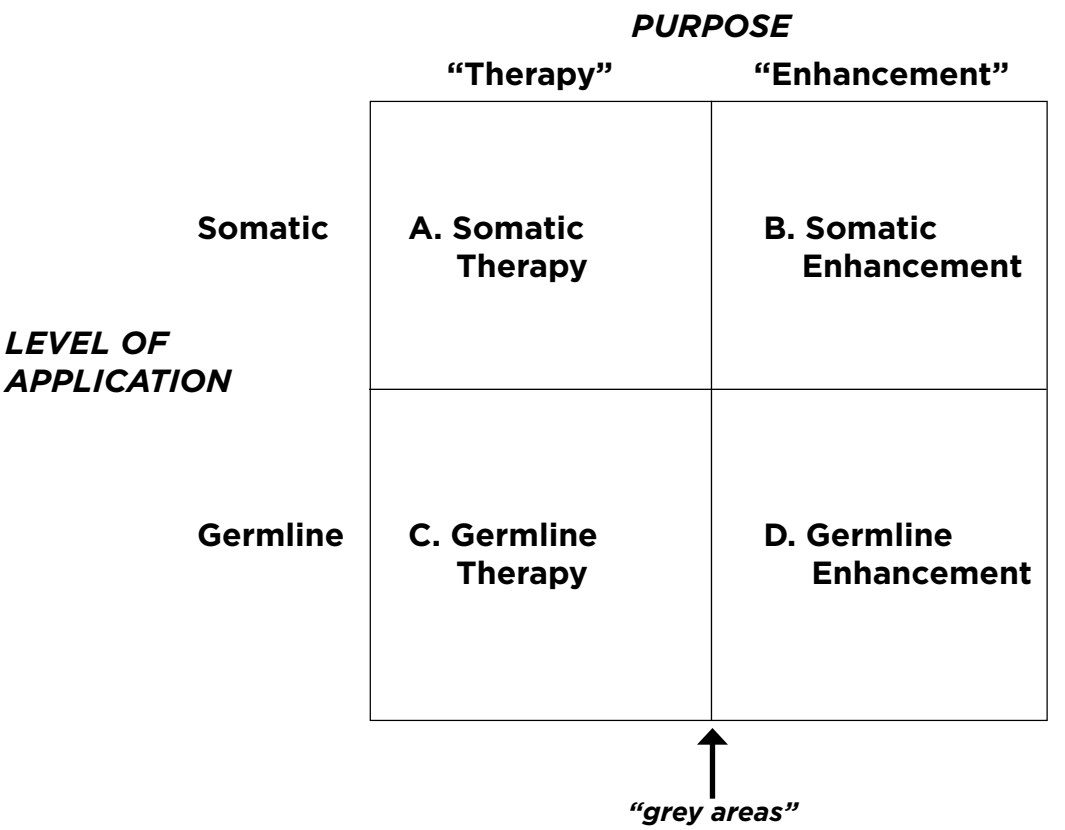
ATTACHMENTS

Attachment A	**Human Genetic Engineering**
Attachment B.	**Summary of National Policies**
Attachment C.	**Summary of International Agreements**
Attachment D.	**Summary of Policies on Embryonic Stem Cell Research**
Attachment E.	**Summary of Policies of OECD States**
Attachment F.	**The Council of Europe Convention on Biomedicine and Human Rights**
Attachment G.	**The Canadian Assisted Human Reproduction Act**

Attachment A. Human Genetic Engineering

I. HUMAN GENETIC MODIFICATION



` II. HUMAN GENETIC TRAIT SELECTION

A. For Social Purposes

B. For Medically-Related Purposes

III. HUMAN CLONING

A. For Reproductive Purposes

B. For Research Purposes

Attachment B: Summary of National Policies

The Table shows the laws and policies currently in effect in all countries regarding selected practices and technologies.

Definitions:

- ***Eggs for Assisted Reproduction:*** the provision of oocytes for use by another woman for reproductive purposes
- ***Eggs for Research:*** the provision of oocytes for use by scientists in research, whether for SCNT or for other purposes
- ***Inheritable Genetic Modification:*** the manipulation or replacement of the genes in a person's egg or sperm cells, such that the changes can be passed on to all succeeding generations
- ***Preimplantation Genetic Diagnosis:*** the testing of one or more zygotes created via IVF procedures in order to select the zygote with which to initiate a pregnancy
- ***Reproductive Cloning:*** the creation of fully gestated human children that are genetically identical to previously existing human beings, whether living or dead
- ***Research Cloning:*** the creation for research purposes of human embryos that are genetically identical to previously existing human beings, living or dead, but will not be brought to term
- ***Sex Selection:*** the choice of the sex of an unborn child, whether before or after conception, either to avoid sex-linked heritable diseases or for personal preference
- ***Surrogacy:*** the practice in which one woman bears a child on behalf of another, whether using the eggs of one of the contracting parties or those of a third woman

Key:

- ***PROHIBITED:*** This practice is prohibited by national law or policies having the force of law.
- ***regulated:*** This practice is allowed and regulated by national law or policies having the force of law.
- ***social prohibited:*** Social (or nonmedical) use of this practice is prohibited by national law or policies having the force of law.
- ***commercial prohibited:*** Commercial use of this practice is prohibited by national law or policies having the force of law, but non-commercial use is allowed.
- ***commercial allowed:*** Commercial use of this practice is allowed by national law or policies having the force of law.
- ***unrecognized:*** Surrogacy contracts are explicitly unrecognized by national law or by other mechanism which carries the force of law.
- ***no policy:*** This practice is not addressed by national law or policies having the force of law.
- ***?:*** It is unknown or unclear whether this practice is addressed by national law or policies having the force of law.

Note: The categories defined in the key and used in the table characterize the policies in any given country in a broad manner. Policy details may vary among countries. Data were compiled by the Center for Genetics and Society and are current as of June 2008. Sources included country- and topic-specific websites, other surveys and inventories, and journal accounts, as well as laws and policy instruments when available in English. Texts of policies are often difficult to interpret, and policies are subject to change.

Summary of National Policies

Country	Eggs for Assisted Reproduction	Eggs for Research	Inheritable Genetic Modification	Preimplantation Genetic Diagnosis	Reproductive Cloning	Research Cloning	Sex Selection	Surrogacy
Afghanistan	?	?	?	?	?	?	?	?
Albania	?	?	?	?	?	?	?	?
Algeria	?	?	?	?	?	?	?	?
Andorra	?	?	?	?	?	?	?	?
Angola	?	?	?	?	?	?	?	?
Antigua and Barbuda	?	?	?	?	?	?	?	?
Argentina	no policy	no policy	no policy	no policy	PROHIBITED	PROHIBITED	no policy	no policy
Armenia	?	?	?	?	?	?	?	?
Australia	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	commercial prohibited; unrecognized
Austria	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Azerbaijan	?	?	?	?	?	?	?	?
Bahamas	?	?	?	?	?	?	?	?
Bahrain	?	?	?	?	?	?	?	?
Bangladesh	?	?	?	?	?	?	?	?
Barbados	?	?	?	?	?	?	?	?
Belarus	?	?	?	?	?	?	?	?
Belgium	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	unrecognized
Belize	?	?	?	?	?	?	?	?
Benin	?	?	?	?	?	?	?	?
Bhutan	?	?	?	?	?	?	?	?
Bolivia	?	?	?	?	?	?	?	?
Bosnia and Herzegovina	?	?	PROHIBITED	social prohibited	?	PROHIBITED	social prohibited	?
Botswana	?	?	?	?	?	?	?	?
Brazil	no policy	no policy	PROHIBITED	no policy	PROHIBITED	PROHIBITED	no policy	no policy
Brunei	?	?	?	?	?	?	?	?
Bulgaria	?	?	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	?
Burkina Faso	?	?	?	?	?	?	?	?
Burundi	?	?	?	?	?	?	?	?
Cambodia	?	?	?	?	?	?	?	?
Cameroon	?	?	?	?	?	?	?	?
Canada	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	commercial prohibited
Cape Verde	?	?	?	?	?	?	?	?
Central African Republic	?	?	?	?	?	?	?	?
Chad	?	?	?	?	?	?	?	?
Chile	no policy	?	?	no policy	?	?	?	?
China	PROHIBITED	commercial prohibited	?	social prohibited	PROHIBITED	regulated	social prohibited	PROHIBITED
Columbia	no policy	?	PROHIBITED	no policy	PROHIBITED	PROHIBITED	no policy	no policy
Comoros	?	?	?	?	?	?	?	?
Cook Islands	?	?	?	?	?	?	?	?
Costa Rica	?	?	PROHIBITED	?	PROHIBITED	PROHIBITED	?	?
Croatia	no policy	no policy	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	no policy
Cuba	?	?	?	?	PROHIBITED	regulated	?	?
Cyprus	?	?	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	?
Czech Republic	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	?
Côte d'Ivoire	?	?	?	?	?	?	?	?
Democratic Republic of the Congo	?	?	?	?	?	?	?	?

ATTACHMENT B, CONT.

Country	Eggs for Assisted Reproduction	Eggs for Research	Inheritable Genetic Modification	Preimplantation Genetic Diagnosis	Reproductive Cloning	Research Cloning	Sex Selection	Surrogacy
Denmark	commercial allowed	permitted	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	commercial prohibited; unrecognized
Djibouti	?	?	?	?	?	?	?	?
Dominica	?	?	?	?	?	?	?	?
Dominican Republic	?	?	?	?	?	?	?	?
Ecuador	no policy	?	?	?	PROHIBITED	PROHIBITED	no policy	no policy
Egypt	no policy	no policy	no policy	no policy	?	no policy	no policy	no policy
El Salvador	?	?	?	?	PROHIBITED	PROHIBITED	?	?
Equatorial Guinea	?	?	?	?	?	?	?	?
Eritrea	?	?	?	?	?	?	?	?
Estonia	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	?
Ethiopia	?	?	?	?	?	?	?	?
Fiji	?	?	?	?	?	?	?	?
Finland	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	PROHIBITED
France	commercial allowed	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Gabon	?	?	?	?	?	?	?	?
Gambia	?	?	?	?	?	?	?	?
Georgia	?	PROHIBITED	PROHIBITED	?	PROHIBITED	PROHIBITED	?	?
Germany	PROHIBITED	?	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Ghana	?	?	?	?	?	?	?	?
Greece	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	commercial prohibited
Grenada	?	?	?	?	?	?	?	?
Guatemala	?	?	?	?	?	?	?	?
Guinea	?	?	?	?	?	?	?	?
Guinea-Bissau	?	?	?	?	?	?	?	?
Guyana	?	?	?	?	?	?	?	?
Haiti	?	?	?	?	?	?	?	?
Honduras	?	?	?	?	?	?	?	?
Hungary	commercial allowed	commercial allowed	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	commercial allowed
Iceland	?	?	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	?
India	no policy	no policy	PROHIBITED	social prohibited	PROHIBITED	regulated	PROHIBITED	commercial allowed
Indonesia	?	?	?	?	?	?	?	?
Iran	?	?	?	?	?	?	?	?
Iraq	?	?	?	?	?	?	?	?
Ireland	?	?	?	?	PROHIBITED	PROHIBITED	?	?
Israel	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	commercial prohibited
Italy	PROHIBITED	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Jamaica	?	?	?	?	?	?	?	?
Japan	PROHIBITED	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	unrecognized
Jordan	no policy	?	?	no policy	?	no policy	no policy	no policy
Kazakhstan	?	?	?	?	?	?	?	?
Kenya	?	?	?	?	?	?	?	?
Kiribati	?	?	?	?	?	?	?	?
Kuwait	?	?	?	?	?	?	?	?
Kyrgyzstan	?	?	?	?	?	?	?	?
Laos	?	?	?	?	?	?	?	?
Latvia	permitted	permitted	?	?	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Lebanon	?	?	?	?	?	?	?	?
Lesotho	?	?	?	?	?	?	?	?
Liberia	?	?	?	?	?	?	?	?
Libya	?	?	?	?	?	?	?	?
Liechtenstein	?	?	?	?	?	?	?	?

ATTACHMENT B, CONT.

Country	Eggs for Assisted Reproduction	Eggs for Research	Inheritable Genetic Modification	Preimplantation Genetic Diagnosis	Reproductive Cloning	Research Cloning	Sex Selection	Surrogacy
Lithuania	?	?	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	social prohibited	?
Luxembourg	?	?	?	?	PROHIBITED	PROHIBITED	?	?
Macedonia	?	?	?	?	?	?	?	?
Madagascar	?	?	?	?	?	?	?	?
Malawi	?	?	?	?	?	?	?	?
Malaysia	no policy	?	?	no policy	?	?	?	no policy
Maldives	?	?	?	?	?	?	?	?
Mali	?	?	?	?	?	?	?	?
Malta	?	?	?	?	?	?	?	?
Marshall Islands	?	?	?	?	?	?	?	?
Mauritania	?	?	?	?	?	?	?	?
Mauritius	?	?	?	?	?	?	?	?
Mexico	no policy	?	?	?	PROHIBITED	?	?	?
Micronesia	?	?	?	?	?	?	?	?
Moldova	?	?	PROHIBITED	?	PROHIBITED	?	?	?
Monaco	?	?	?	?	?	?	?	?
Mongolia	?	?	?	?	?	?	?	?
Montenegro	?	?	?	?	?	?	?	?
Morocco	no policy	no policy	?	no policy	?	?	?	no policy
Mozambique	?	?	?	?	?	?	?	?
Myanmar	?	?	?	?	?	?	?	?
Namibia	?	?	?	?	?	?	?	?
Nauru	?	?	?	?	?	?	?	?
Nepal	?	?	?	?	?	?	?	?
Netherlands	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	commercial prohibited
New Zealand	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	PROHIBITED	commercial prohibited; unrecognized
Nicaragua	?	?	?	?	?	?	?	?
Niger	?	?	?	?	?	?	?	?
Nigeria	?	?	?	?	?	?	?	?
North Korea	?	?	?	?	?	?	?	?
Norway	PROHIBITED	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Oman	?	?	?	?	?	?	?	?
Pakistan	?	?	?	?	?	?	?	?
Palau	?	?	?	?	?	?	?	?
Panama	?	?	?	?	PROHIBITED	PROHIBITED	?	?
Papua New Guinea	?	?	?	?	?	?	?	?
Paraguay	?	?	?	?	?	?	?	?
Peru	no policy	?	PROHIBITED	no policy	PROHIBITED	PROHIBITED	?	no policy
Philippines	no policy	no policy	?	?	PROHIBITED	?	?	no policy
Poland	?	?	?	?	PROHIBITED	?	?	?
Portugal	no policy	?	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	no policy
Qatar	?	?	?	?	?	?	?	?
Republic of the Congo	?	?	?	?	?	?	?	?
Romania	no policy	?	PROHIBITED	no policy	PROHIBITED	PROHIBITED	?	no policy
Russia	commercial allowed	commercial allowed	?	social prohibited	?	?	social prohibited	commercial allowed
Rwanda	?	?	?	?	?	?	?	?
Saint Kitts and Nevis	?	?	?	?	?	?	?	?
Saint Lucia	?	?	?	?	?	?	?	?
Saint Vincent and the Grenadines	?	?	?	?	?	?	?	?
Samoa	?	?	?	?	?	?	?	?
San Marino	?	?	?	?	?	?	?	?
Sao Tome and Principe	?	?	?	?	?	?	?	?
Saudi Arabia	?	?	?	?	?	?	?	?
Senegal	?	?	?	?	?	?	?	?

ATTACHMENT B, CONT.

Country	Eggs for Assisted Reproduction	Eggs for Research	Inheritable Genetic Modification	Preimplantation Genetic Diagnosis	Reproductive Cloning	Research Cloning	Sex Selection	Surrogacy
Serbia	?	?	?	?	?	?	?	?
Seychelles	?	?	?	?	?	?	?	?
Sierra Leone	?	?	?	?	?	?	?	?
Singapore	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	no policy
Slovakia	?	?	PROHIBITED	?	PROHIBITED	PROHIBITED	?	?
Slovenia	commercial prohibited	?	PROHIBITED	?	PROHIBITED	PROHIBITED	?	PROHIBITED
Solomon Islands	?	?	?	?	?	?	?	?
Somalia	?	?	?	?	?	?	?	?
South Africa	no policy	no policy	PROHIBITED	no policy	PROHIBITED	PROHIBITED	no policy	no policy
South Korea	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	PROHIBITED	no policy
Spain	commercial allowed	commercial allowed	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	unrecognized
Sri Lanka	?	?	?	?	?	?	?	?
Sudan	?	?	?	?	?	?	?	?
Suriname	?	?	?	?	?	?	?	?
Swaziland	?	?	?	?	?	?	?	?
Sweden	permitted	permitted	PROHIBITED	?	PROHIBITED	regulated	?	PROHIBITED
Switzerland	PROHIBITED	?	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Syrian Arab Republic	?	?	?	?	?	?	?	?
Taiwan	commercial allowed	commercial allowed	?	?	PROHIBITED	regulated	?	PROHIBITED
Tajikistan	?	?	?	?	?	?	?	?
Tanzania	?	?	?	?	?	?	?	?
Thailand	no policy	?	?	?	PROHIBITED	regulated	?	no policy
Timor-Leste	?	?	?	?	?	?	?	?
Togo	?	?	?	?	?	?	?	?
Tonga	?	?	?	?	?	?	?	?
Trinidad and Tobago	?	?	?	?	?	?	?	?
Tunisia	PROHIBITED	?	?	?	PROHIBITED	PROHIBITED	?	PROHIBITED
Turkey	PROHIBITED	?	PROHIBITED	social prohibited	PROHIBITED	PROHIBITED	social prohibited	PROHIBITED
Turkmenistan	?	?	?	?	?	?	?	?
Tuvalu	?	?	?	?	?	?	?	?
Uganda	?	?	?	?	?	?	?	?
Ukraine	?	?	?	?	PROHIBITED	?	?	?
United Arab Emirates	?	?	?	?	?	?	?	?
United Kingdom	commercial prohibited	commercial prohibited	PROHIBITED	social prohibited	PROHIBITED	regulated	social prohibited	commercial prohibited
United States of America	no policy	no policy	no policy	no policy	no policy	no policy	no policy	no policy
Uruguay	no policy	?	?	no policy	?	?	?	no policy
Uzbekistan	?	?	?	?	?	?	?	?
Vanuatu	?	?	?	?	?	?	?	?
Venezuela	no policy	?	?	no policy	?	?	?	no policy
Vietnam	commercial prohibited	?	PROHIBITED	?	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Yemen	?	?	?	?	?	?	?	?
Zambia	?	?	?	?	?	?	?	?
Zimbabwe	?	?	?	?	?	?	?	?

Attachment C: Summary of International Agreements

The Table shows the current status in all countries of selected intergovernmental agreements. It also shows how each country voted on the 2005 UN Human Cloning Declaration.

Definitions:

- ***1997 COE Biomedicine Convention:*** The Council of Europe (COE) is an international organization of 47 member countries that works to foster democracy and human rights. Its Convention on Biomedicine and Human Rights explicitly prohibits inheritable genetic modification, somatic genetic modification for enhancement purposes, social sex selection and the creation of human embryos solely for research purposes. The Convention went into force in 1998.[1]
- ***1998 COE Cloning Convention:*** This additional protocol to the COE Biomedicine Convention, prompted by then-recent scientific events, specifically banned human reproductive cloning. It went into force in 1998.[2]
- ***2005 UN Cloning Vote:*** After discussions lasting several years, a non-binding Declaration implying opposition to both reproductive and research cloning was passed with a plurality of votes (46%) and thus, under UN rules, became the official UN position.[3]
- ***2005 UNESCO Sports Doping Convention:*** This incorporated the previous World Anti-Doping Code, which was drawn up by the World Anti-Doping Agency (originally established by the International Olympic Committee) and until the UNESCO Convention was negotiated could not be legally binding on national governments. It addresses the use of steroids and other banned substances, and includes a prohibition of gene doping.[4]

Key:

- ***RATIFIED:*** This country has ratified this measure, and thus agrees to abide by its provisions.
- ***signed:*** This country has signed this measure, indicating an intent to ratify it.
- ***n/a:*** This country is not a member of the intergovernmental organization responsible for this item.
- ***blank cell:*** This country has neither signed nor ratified this measure.

2005 UN Cloning Vote

- ***YES:*** This country voted in favor of the Declaration, indicating support for a ban on both reproductive and research cloning.
- ***no:*** This country voted against the Declaration, indicating support for a ban on reproductive cloning only.
- ***abstain:*** This country took an official position of abstaining from voting on the Declaration.
- ***no vote:*** This country's delegate was absent at the time of the vote, or otherwise refrained from voting.

Note: Data were compiled by the Center for Genetics and Society from official records, and are current as of June 2008.

1 http://conventions.coe.int/treaty/en/treaties/html/164.htm

2 http://conventions.coe.int/Treaty/EN/Treaties/Html/168.htm

3 For a full discussion, see Center for Genetics and Society, "The United Nations Human Cloning Treaty Debate, 2000–2005," June 1st, 2006; available at http://www.geneticsandsociety.org/article.php?id=338.

4 http://portal.unesco.org/en/ev.php-URL_ID=31037&URL_DO=DO_TOPIC&URL_SECTION=201.html

Summary of International Agreements

Country	1997 COE Biomedicine Convention	1998 COE Cloning Convention	2005 UN Cloning Vote	2005 UNESCO Sports Doping Convention
Afghanistan	n/a	n/a	YES	
Albania			YES	RATIFIED
Algeria	n/a	n/a	abstained	RATIFIED
Andorra			YES	
Angola	n/a	n/a	abstained	
Antigua and Barbuda	n/a	n/a	no vote	
Argentina	n/a	n/a	abstained	RATIFIED
Armenia			no vote	
Australia	n/a	n/a	YES	RATIFIED
Austria			YES	RATIFIED
Azerbaijan			abstained	RATIFIED
Bahamas	n/a	n/a	abstained	RATIFIED
Bahrain	n/a	n/a	YES	
Bangladesh	n/a	n/a	YES	RATIFIED
Barbados	n/a	n/a	abstained	RATIFIED
Belarus			no	
Belgium			no	
Belize	n/a	n/a	YES	
Benin	n/a	n/a	YES	
Bhutan	n/a	n/a	no vote	
Bolivia	n/a	n/a	YES	RATIFIED
Bosnia and Herzegovina	RATIFIED		YES	
Botswana	n/a	n/a	no vote	
Brazil	n/a	n/a	no	RATIFIED
Brunei	n/a	n/a	YES	RATIFIED
Bulgaria	RATIFIED	RATIFIED	no	RATIFIED
Burkina Faso	n/a	n/a	abstained	
Burundi	n/a	n/a	YES	RATIFIED
Cambodia	n/a	n/a	no	RATIFIED
Cameroon	n/a	n/a	abstained	RATIFIED
Canada	n/a	n/a	no	RATIFIED
Cape Verde	n/a	n/a	abstained	
Central African Republic	n/a	n/a	no vote	
Chad	n/a	n/a	no vote	
Chile	n/a	n/a	YES	
China			no	RATIFIED
Columbia	n/a	n/a	abstained	
Comoros	n/a	n/a	YES	
Cook Islands	n/a	n/a		RATIFIED
Costa Rica	n/a	n/a	YES	
Croatia	RATIFIED	RATIFIED	YES	RATIFIED
Cuba	n/a	n/a	no	
Cyprus	RATIFIED	RATIFIED	no	
Czech Republic	RATIFIED	RATIFIED	no	RATIFIED
Côte d'Ivoire	n/a	n/a	YES	
Democratic Republic of the Congo	n/a	n/a	YES	
Denmark	RATIFIED	signed	no	RATIFIED
Djibouti	n/a	n/a	YES	
Dominica	n/a	n/a	no vote	
Dominican Republic	n/a	n/a	YES	
Ecuador			YES	RATIFIED
Egypt	n/a	n/a	abstained	RATIFIED
El Salvador			YES	
Equatorial Guinea	N/A	N/A	YES	
Eritrea	N/A	N/A	YES	
Estonia	RATIFIED	RATIFIED	no	RATIFIED
Ethiopia	N/A	N/A	YES	
Fiji			no vote	
Finland	signed	signed	no	RATIFIED

ATTACHMENT C, CONT.

Country	1997 COE Biomedicine Convention	1998 COE Cloning Convention	2005 UN Cloning Vote	2005 UNESCO Sports Doping Convention
France	signed	signed	no	RATIFIED
Gabon	n/a	n/a	no	RATIFIED
Gambia	n/a	n/a	no vote	
Georgia	RATIFIED	RATIFIED	YES	
Germany			YES	RATIFIED
Ghana	n/a	n/a	no vote	RATIFIED
Greece	RATIFIED	RATIFIED	no vote	RATIFIED
Grenada	n/a	n/a	YES	
Guatemala	n/a	n/a	YES	RATIFIED
Guinea			no vote	
Guinea-Bissau	n/a	n/a	no vote	
Guyana	n/a	n/a	YES	
Haiti	n/a	n/a	YES	
Honduras	n/a	n/a	YES	
Hungary	RATIFIED	RATIFIED	YES	RATIFIED
Iceland	RATIFIED	RATIFIED	no	RATIFIED
India			no	RATIFIED
Indonesia	n/a	n/a	abstained	RATIFIED
Iran	n/a	n/a	abstained	
Iraq			YES	
Ireland			YES	
Israel			abstained	
Italy	signed	signed	YES	RATIFIED
Jamaica	n/a	n/a	no	RATIFIED
Japan	n/a	n/a	no	RATIFIED
Jordan	n/a	n/a	abstained	
Kazakhstan	n/a	n/a	YES	
Kenya	n/a	n/a	YES	
Kiribati	n/a	n/a	no vote	
Kuwait	n/a	n/a	YES	RATIFIED
Kyrgyzstan	n/a	n/a	no vote	
Laos	n/a	n/a	no	
Latvia	signed	signed	no	RATIFIED
Lebanon	n/a	n/a	abstained	
Lesotho	n/a	n/a	YES	
Liberia	n/a	n/a	YES	
Libya	n/a	n/a	no vote	RATIFIED
Liechtenstein			YES	
Lithuania	RATIFIED	RATIFIED	no	RATIFIED
Luxembourg	signed	signed	no	RATIFIED
Macedonia	signed	signed	YES	
Madagascar	n/a	n/a	YES	
Malawi	n/a	n/a	no vote	
Malaysia	n/a	n/a	abstained	RATIFIED
Maldives	n/a	n/a	abstained	
Mali	n/a	n/a	no vote	RATIFIED
Malta			YES	
Marshall Islands	n/a	n/a	YES	
Mauritania	n/a	n/a	no vote	
Mauritius	n/a	n/a	YES	RATIFIED
Mexico	n/a	n/a	YES	RATIFIED
Micronesia	n/a	n/a	YES	
Moldova	RATIFIED	RATIFIED	abstained	RATIFIED
Monaco			YES	RATIFIED

ATTACHMENT C, CONT.

Country	1997 COE Biomedicine Convention	1998 COE Cloning Convention	2005 UN Cloning Vote	2005 UNESCO Sports Doping Convention
Mongolia	n/a	n/a	abstained	RATIFIED
Montenegro	signed			
Morocco	n/a	n/a	YES	
Mozambique	n/a	n/a	no vote	RATIFIED
Myanmar	n/a	n/a	abstained	
Namibia	n/a	n/a	abstained	RATIFIED
Nauru	n/a	n/a	no vote	RATIFIED
Nepal	n/a	n/a	abstained	
Netherlands	signed	signed	no	RATIFIED
New Zealand	n/a	n/a	no	RATIFIED
Nicaragua	n/a	n/a	YES	
Niger	n/a	n/a	no vote	RATIFIED
Nigeria	n/a	n/a	no vote	RATIFIED
North Korea	n/a	n/a	no	
Norway	RATIFIED	signed	no	RATIFIED
Oman	n/a	n/a	abstained	RATIFIED
Pakistan	n/a	n/a	abstained	RATIFIED
Palau	n/a	n/a	YES	
Panama	n/a	n/a	YES	RATIFIED
Papua New Guinea	n/a	n/a	no vote	
Paraguay	n/a	n/a	YES	
Peru	n/a	n/a	no vote	RATIFIED
Philippines	n/a	n/a	YES	
Poland	signed	signed	YES	RATIFIED
Portugal	RATIFIED	RATIFIED	YES	RATIFIED
Qatar	n/a	n/a	YES	RATIFIED
Republic of the Congo	n/a	n/a	no vote	
Romania	RATIFIED	RATIFIED	abstained	RATIFIED
Russia			no vote	RATIFIED
Rwanda	n/a	n/a	YES	
Saint Kitts and Nevis	n/a	n/a	YES	RATIFIED
Saint Lucia	n/a	n/a	YES	RATIFIED
Saint Vincent and the Grenadines	n/a	n/a	YES	
Samoa	n/a	n/a	YES	RATIFIED
San Marino	RATIFIED	signed	YES	
Sao Tome and Principe	n/a	n/a	YES	
Saudi Arabia	n/a	n/a	YES	
Senegal	n/a	n/a	no vote	RATIFIED
Serbia	signed		abstained	
Seychelles	n/a	n/a	no vote	RATIFIED
Sierra Leone	n/a	n/a	YES	
Singapore	n/a	n/a	no	RATIFIED
Slovakia	RATIFIED	RATIFIED	YES	RATIFIED
Slovenia	RATIFIED	RATIFIED	YES	
Solomon Islands	n/a	n/a	YES	
Somalia	n/a	n/a	abstained	
South Africa	n/a	n/a	abstained	RATIFIED
South Korea	n/a	n/a	no	RATIFIED
Spain	RATIFIED	RATIFIED	no	RATIFIED
Sri Lanka	n/a	n/a	abstained	
Sudan	n/a	n/a	YES	
Suriname	n/a	n/a	YES	

ATTACHMENT C, CONT.

Country	1997 COE Biomedicine Convention	1998 COE Cloning Convention	2005 UN Cloning Vote	2005 UNESCO Sports Doping Convention
Swaziland	n/a	n/a	no vote	
Sweden	signed	signed	no	RATIFIED
Switzerland	signed	signed	YES	
Syrian Arab Republic	n/a	n/a	abstained	
Taiwan				
Tajikistan	n/a	n/a	YES	
Tanzania	n/a	n/a	YES	
Thailand	n/a	n/a	no	RATIFIED
Timor-Leste	n/a	n/a	YES	
Togo	n/a	n/a	no vote	
Tonga	n/a	n/a	no	
Trinidad and Tobago	n/a	n/a	YES	RATIFIED
Tunisia	n/a	n/a	abstained	RATIFIED
Turkey	RATIFIED	signed	abstained	
Turkmenistan	n/a	n/a	no vote	
Tuvalu	n/a	n/a	no vote	
Uganda	n/a	n/a	YES	
Ukraine	signed	signed	abstained	RATIFIED
United Arab Emirates	n/a	n/a	YES	
United Kingdom			no	RATIFIED
United States of America	n/a	n/a	YES	
Uruguay			abstained	RATIFIED
Uzbekistan	n/a	n/a	YES	
Vanuatu	n/a	n/a	no vote	
Venezuela			no vote	
Vietnam	n/a	n/a	no vote	
Yemen	n/a	n/a	abstained	
Zambia	n/a	n/a	YES	
Zimbabwe	n/a	n/a	abstained	

Attachment D: Summary of Policies on Embryonic Stem Cell Research

This Table groups countries according to key aspects of their policies regarding human embryonic stem cell research (hESC). Countries with no known policies, or whose policies are known to be unclear (for example, Ireland), are not included. The United States is not included, since national policy is currently based largely on executive funding decisions rather than legislation, and policies among the states vary widely.

Definitions:

- ***SCNT Allowed:*** Research cloning is specifically permitted under certain conditions.
- ***Use of Leftover Embryos Allowed:*** Research cloning is prohibited, but hESC using embryos left over from fertility treatment is permitted, explicitly or implicitly.
- ***Specific Cell Lines Only:*** Research on hESCs is only permitted using cell lines created before a certain date.
- ***Prohibited:*** Research using embryos or cell products derived from embryos is prohibited.

Note: The data is largely based on a UK Human Fertility and Embryology Authority (HFEA) publication and on the Hinxton Group database on World Stem Cell Policies.[1] However, the Center for Genetics and Society interprets policies in South Africa as less permissive and in Finland as more permissive, and adds Cuba and Thailand to the list. Several Central and South American nations are consistently listed as having prohibitive policies due to constitutional expressions extending a "right to life" to conceived or unborn persons, but there is some doubt as to whether these apply to all research.

Summary of Policies on Embryonic Stem Cell Research

SCNT Allowed	Use of Leftover Embryos Allowed		Specific Cell Lines Only	Prohibited
Australia	Argentina	Iran	Germany	Austria
Belgium	Brazil	Latvia	Italy	Colombia
China	Bulgaria	Moldova		Costa Rica
Cuba	Canada	Netherlands		Ecuador
Finland	Croatia	New Zealand		El Salvador
India	Cyprus	Portugal		Lithuania
Israel	Czech Republic	Romania		Norway
Japan	Denmark	Russia		Panama
Singapore	Estonia	San Marino		Peru
South Korea	France	Slovenia		Poland
Spain	Georgia	South Africa		Slovakia
Sweden	Greece	Switzerland		Tunisia
Thailand	Hungary	Taiwan		
United Kingdom	Iceland	Turkey		

1 HFEA, *Hybrids and Chimeras: Findings of the Consultation*, Annex C – International Perspective, September 5, 2007; available from http://www.hfea.gov.uk/en/1579.html
The Hinxton Group, "World Stem Cell Policies," http://www.hinxtongroup.org/wp.html

Attachment E: Summary of Policies of OECD States

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation of thirty countries that accept the principles of representative democracy and free market economy. It provides a forum in which governments can share policy experiences, identify good practices, and coordinate domestic and international policies addressing economic, environmental and social issues.

Definitions:

- ***Reproductive Cloning:*** the creation of fully gestated human children that are genetically identical to previously existing human beings, whether living or dead
- ***Inheritable Genetic Modification:*** the manipulation or replacement of the genes in a person's egg or sperm cells, such that the changes can be passed on to all succeeding generations
- ***Non-Medical Trait Selection:*** the selection of eggs, sperm or embryos that possess genes associated with particular traits considered desirable, even if the unwanted traits do not suggest an increased likelihood of developing disease, without actually modifying those genes
- ***Research Cloning:*** the creation of fully gestated human children that are genetically identical to previously existing human beings, whether living or dead
- ***Medical Trait Selection:*** the selection of eggs, sperm or embryos that possess genes associated with particular traits, in order to avoid an increased likelihood of developing disease, without actually modifying those genes

Key:

- ***PROHIBITED:*** This practice is prohibited by national law or policies having the force of law.
- ***allowed:*** This practice is permitted (and generally regulated) by national law or policies having the force of law.
- ***no policy:*** This practice is not addressed by national law or policies having the force of law.
- ***?:*** It is unknown or unclear whether this practice is addressed by national law or policies having the force of law.

Note: The categories defined in the key and used in the table characterize the policies in any given country in a broad manner. Policy details may vary among countries. Data were compiled by the Center for Genetics and Society and are current as of June 2008. Sources included country- and topic-specific websites, other surveys and inventories, and journal accounts, as well as laws and policy instruments when available in English. Texts of policies are often difficult to interpret, and policies are subject to change.

Summary of Policies of OECD States

Country	Reproductive Cloning	Inheritable Genetic Modification	Non-Medical Trait Selection	Research Cloning	Medical Trait Selection
Australia	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
Austria	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Belgium	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
Canada	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Czech Republic	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Denmark	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Finland	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
France	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Germany	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Greece	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Hungary	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Iceland	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Ireland	PROHIBITED	?	?	PROHIBITED	?
Italy	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Japan	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
Luxembourg	PROHIBITED	?	?	PROHIBITED	?
Mexico	PROHIBITED	?	?	?	?
Netherlands	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
New Zealand	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Norway	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Poland	PROHIBITED	?	?	?	?
Portugal	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
Slovakia	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	?
South Korea	PROHIBITED	PROHIBITED	PROHIBITED	allowed	PROHIBITED
Spain	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
Sweden	PROHIBITED	PROHIBITED	?	allowed	?
Switzerland	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED
Turkey	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	allowed
United Kingdom	PROHIBITED	PROHIBITED	PROHIBITED	allowed	allowed
United States of America	no policy	no policy	no policy	no policy	no policy

Attachment F: The Council of Europe *Convention on Biomedicine and Human Rights*

The Council of Europe is an organization of 47 European countries that works to foster democracy and human rights among its members. The Council maintains a Bioethics Division within its Legal Affairs field, guided by a Steering Committee on Bioethics (CDBI).

The Council's landmark Convention on Biomedicine and Human Rights was opened for signatures in 1997 and went into force in 1998. It explicitly prohibits inheritable genetic modification, somatic genetic modification for enhancement purposes, social sex selection, and the creation of human embryos solely for research purposes:

> ***Article 11*** **–** *Non-discrimination:* Any form of discrimination against a person on grounds of his or her genetic heritage is prohibited.
>
> ***Article 12*** – *Predictive genetic tests:* Tests which are predictive of genetic diseases or which serve either to identify the subject as a carrier of a gene responsible for a disease or to detect a genetic predisposition or susceptibility to a disease may be performed only for health purposes or for scientific research linked to health purposes, and subject to appropriate genetic counseling.
>
> ***Article 13*** – *Interventions on the human genome:* An intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants.
>
> ***Article 14*** – *Non-selection of sex:* The use of techniques of medically assisted procreation shall not be allowed for the purpose of choosing a future child's sex, except where serious hereditary sex-related disease is to be avoided.
>
> ***Article 18*** – *Research on embryos in vitro:* The creation of human embryos for research purposes is prohibited.
>
> ***Article 21*** – *Prohibition of financial gain:* The human body and its parts shall not, as such, give rise to financial gain.

Human reproductive cloning was banned by an Additional Protocol on the Prohibition of Cloning Human Beings, which went into force in 1998:

> ***Article 1*** - Any intervention seeking to create a human being genetically identical to another human being, whether living or dead, is prohibited.

In other articles the Convention addresses additional topics around which international consensus may be possible. These include:

- The necessity of equitable access to health care
- Adherence to professional obligations and standards
- Commitment to free and informed consent, and special protection for those not able to give consent
- Commitment to the protection of research subjects
- Procedures concerning organ and tissue removal from living donors for transplantation purposes
- Respect for privacy and the right to know regarding information collected about one's genetic makeup

Attachment G: The Canadian Assisted Human Reproduction Act

In 2004 the Canadian Parliament approved the Assisted Human Reproduction Act (AHRA). The legislation drew clear lines prohibiting unacceptable applications of new human genetic and reproductive technologies while allowing beneficial applications to proceed in a socially accountable manner.

Canada grounded the AHRA in an explicit "declaration of principles," including:

- the health and well-being of women and children
- nondiscrimination; non-commodification
- free and informed consent
- human health, safety, dignity and rights in the use of assisted reproduction
- human individuality and diversity, and the integrity of the human genome.

The AHRA prohibits a number of practices, including:

- the creation of cloned embryos, whether for research or reproduction
- the creation of human embryos solely for research
- germline genetic modification
- human/non-human hybrids and chimeras
- sex selection except to "prevent, diagnose or treat a sex-linked disorder or disease"
- payments for surrogacy, gametes, or embryos.
- Removing reproductive material from a deceased person without their prior written consent

Permitted practices include:

- *in vitro* fertilization
- sex selection for sex-linked diseases
- non-commercial surrogacy
- embryonic stem cell research using embryos created but not used for reproductive purposes.

The AHRA established the Assisted Human Reproduction Agency of Canada to develop and oversee regulations covering these and other permitted activities. The Agency licenses and monitors all private and public fertility clinics, research facilities and other institutions whose research or commercial activity involves human gametes or embryos. It is authorized to amend, suspend or revoke licenses if necessary.

The AHRA also monitors and evaluates national and international developments related to assisted human reproduction and related practices; consults with and provides information to stakeholders within Canada and internationally; and advises national authorities on these matters.

The AHRA is governed by a 13-member Board and chief executive officer, both of whom are appointed by the federal Cabinet and report to the Ministry of Health. Board members serve 3-year terms and are to be selected from a wide range of relevant backgrounds, "including health sciences; health law; social ethics; or a relevant field in the social sciences (such as women's and children's health)," but cannot be in a position regulated by the Agency. Senators voting for the bill recommended that at least 50% of the members be women.

ABOUT CGS

The **Center for Genetics and Society** is a nonprofit public affairs organization working to encourage responsible uses and effective societal governance of the new human genetic and reproductive technologies. We support benign and beneficent medical applications of these technologies and oppose those applications that objectify and commodify human life and threaten to divide human society. We work in a context of support for the equitable provision of health technologies domestically and internationally; for women's health and reproductive rights; for the protection of our children; for the rights of the disabled; and for precaution in the use of powerful new technologies.

Please contact us for information on resources, events and programs.

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