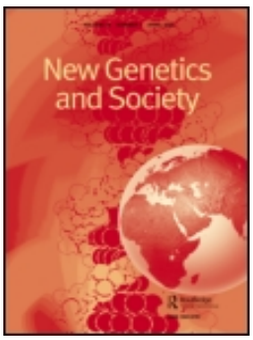

New Genetics and Society

ISSN: 1463-6778 (Print) 1469-9915 (Online) Journal homepage: https://www.tandfonline.com/loi/cngs20

In the democracies of DNA: ontological uncertainty and political order in three states

Sheila Jasanoff

To cite this article: Sheila Jasanoff (2005) In the democracies of DNA: ontological uncertainty and political order in three states, New Genetics and Society, 24:2, 139-156, DOI: 10.1080/14636770500190864

To link to this article: https://doi.org/10.1080/14636770500190864

Published online: 19 Aug 2006.

New Genetics and Society, Vol. 24, No. 2, August 2005

Routledge
Taylor & Francis Group

In the democracies of DNA: ontological uncertainty and political order in three states

SHEILA JASANOFF
Harvard University, John F. Kennedy School of Government, Cambridge, Massachusetts, USA

ABSTRACT *This paper compares the regulation of biotechnology in Britain, Germany and the United States and shows that systematic differences have developed around four issues: abortion, assisted reproduction, stem cells, and genetically modified crops and foods. Policy choices with respect to these issues reflect the capacity of each nation's regulatory institutions to deal with the scientific, social and ethical uncertainties around biotechnology. National regulatory frameworks constitute an apparatus of collective sense-making through which governments and publics interpret biotechnology's risks and promises. Specifically, regulatory choices position the novel ontologies created by biotechnology either on the side of the familiar and manageable or on the side of the unknown and insupportably risky. The comparison shows that public responses to biotechnology are embedded within robust and coherent political cultures and are not ad hoc expressions of concern that vary unpredictably from issue to issue.*

Efforts to manage and control the development of biotechnology in its early decades exposed a paradox. When promoting innovation, states and private corporations characterized this technological sector as a singular, well-demarcated site for public policy, held together by its distinctive means of production (e.g., genetic manipulation), its unique property regimes (e.g., patents on life), its institutionally hybrid methods of collaboration (e.g., university-industry partnerships), and above all its ultimate goals with regard to living things (to improve on 'natural' entities by engineering them for greater purity, productivity, efficiency or novel characteristics). Yet, when it came to regulation, industry lobbying, governmental action, and public deliberation were all structured along so-called vertical lines, corresponding to specific commercial product categories. In the context of control, biotechnology was represented not as a revolutionary, transformative shift in our modes of industrial production, but as just one more incremental step, barely deserving a second glance, in humankind's long involvement with making nature more productive and pliant.

The trend toward regulating biotechnology by product classes emerged earliest and most explicitly in the United States, where policymakers from the 1980s onward repudiated legislation targeted at the process of genetic manipulation (Jasanoff, 1995). But the European Union, too, partly followed suit, moving

Correspondence to: Sheila Jasanoff, Harvard University, John F. Kennedy School of Government, 79 JFK Street, Cambridge, MA 02138, USA. Email: sheila_jasanoff@harvard.edu

ISSN 1463-6778 print/ISSN 1469-9915 online/05/020139-17 © 2005 Taylor & Francis
DOI: 10.1080/14636770500190864

away from the process-based approach that had characterized the directives on biotechnology adopted in 1990. At the most basic level, policy frameworks tended to distinguish 'red' biotechnology, directed toward pharmaceutical development, from 'green' biotechnology, aimed at agricultural production. After all, the reasoning went, the former focuses on questions of human health, and increasingly also on biomedical ethics, whereas the latter engages with questions of environmental risk and threats to biodiversity. These differences seemed to demand recourse to different domains of technical expertise, as well as engagement with different constellations of stakeholders. Reflecting these realities, most governments had long since placed regulatory authority over pharmaceuticals and agricultural commodities in different agencies or ministries (e.g., in the United States, the Food and Drug Administration for the former, and the Department of Agriculture for the latter). In the logic of modern governance, it seemed only natural to divide up the technical and political dimensions of regulating biotechnology among these pre-existing sectors of bureaucratic competence.

Public responses around the world, however, have questioned the conceptual bifurcation that treats biotechnology as unitary for production and promotion, but multiple for regulation. The logics and discourses of state action, driven by specialized expertise and bureaucratic rationality, do not map so neatly onto the logics of public approval and acceptance—especially in a culturally heterogeneous, global public sphere. From the bottom-up perspective of citizens who have to live in, and with, a world modified by biotechnology, there are cross-cutting questions of metaphysics, epistemology and ethics that unify the disparate areas of technological application. As research on public opinion has shown, there are features of accountability and reassurance that many people hope to find in the emerging regulatory structures for biotechnology, and those features are not constrained by the boundaries of traditional, product-oriented health and safety regulation (Marris *et al.*, 2001). The very same features that have led biotechnology enthusiasts to embrace it as a revolutionary means of production have also persuaded many consumers and members of the public of the need for new forms of engagement with biotechnology's overall aims and purposes. Neither the timing nor the discursive format of regulatory proceedings offers scope for this kind of broadly normative engagement. In short, the interests of deliberative democracy are not wholly satisfied by policy institutions whose role and remit were molded primarily by concerns for safe and efficient product innovation.

Cross-national stand-offs over the commercialization of genetically modified (GM) crops, the patenting of gene fragments and higher life forms, and the divergent policy regimes that have developed around research with embryonic stem cells give tangible evidence of the conflicts that can arise if tacit public expectations with respect to the management of biotechnology are not met. These frictions, arising only after extensive state and private investments in research and product development, run counter to the interests of both scientists and the public in the free flow of scientific knowledge. They also disrupt the global commitment to free trade enshrined in the World Trade Organization. It seems clear that both national leaders and the publics they answer to would benefit

from a deeper understanding of the conditions that have led their counterparts in other nations to substantially different conclusions about the pros and cons of biotechnology. Whether or not such understanding leads to greater convergence in public values or policy action, it should increase the intelligence and sophistication of the global debate on these issues.

The social sciences can contribute importantly to this kind of illumination through comparative, cross-national analysis of regulatory politics. It is widely recognized by now that public problems do not simply appear on policy agendas, as if placed there through the direct imprint of exogenous events. Rather, they are framed in particular ways by cultural commitments that predispose societies, no less than the individuals within them, to fit their experiences into specific types of causal narratives.[1] These narratives are grounded in long-standing institutional practices and ways of knowing that enable societies at once to conceptualize and find solutions to newly perceived threats to their security or well-being. Even the most technical issues are interpreted in the context of established, but varied, social approaches to defining and coping with public problems. These insights, largely derived from studies of domestic policy and politics, acquire added significance when translated into a comparative framework. By exposing underlying sources of variation, cross-cultural comparisons can help explain why national publics are more or less inclined to accept particular forms of technological change. At the same time, by grounding risk perception and regulatory behavior in the deeper matrix of political culture, comparative work resists dismissing the opposition to biotechnology as nothing more than an unreasoning fear of novelty, grounded in the public's ignorance of scientific facts.

This paper compares the regulatory uptake of biotechnology in three advanced industrial democracies—Britain, Germany and the United States—and shows that systematic differences have developed around several major applications of genetic manipulation. Four are described below: abortion, assisted reproduction, stem cells, and genetically modified crops and foods. Different policy choices with respect to each of these issues reflect in part the diverse capacities of each nation's regulatory institutions to deal with the scientific, social and ethical uncertainties around biotechnology. These institutional frameworks constitute in effect an apparatus of collective sense-making through which national governments and publics interpret what biotechnology both promises and threatens. More specifically, national regulatory approaches help to position the ontological novelties created by biotechnology either on the side of the familiar and manageable or on the side of the unknown and perhaps insupportably risky. Public responses to biotechnology are thus shown to be embedded within robust and coherent political cultures rather than being ad hoc and contingent expressions of concern that vary unpredictably from issue to issue.[2]

Sites of divergence: policy responses to biotechnology

In February 1997, newspapers in the United Kingdom carried stories about a historic victory on an unlikely frontier. Diane Blood, a 30-year-old public relations

consultant from Nottinghamshire, had won permission to be inseminated with sperm taken from her dead husband, Stephen. British administrative and legal authorities had denied Diane the right to be inseminated with Stephen's sperm because it had been removed without his consent, at *her* request, while he was dying of bacterial meningitis. But lack of consent, the UK courts held on appeal, only barred insemination in Britain. Under European law, Diane could not be deprived of her right to take the sperm to another country, such as Belgium, whose laws permitted a pregnancy to be initiated under these circumstances. Diane eventually bore two children conceived through artificial insemination with her late husband's sperm in Brussels.

Though the main elements of the story are unambiguous, press reports on the February day when the news of Diane Blood's legal victory broke show that there were sharply different ways of interpreting what was at stake. *The Daily Telegraph*, a pillar of the British press, carried the headline, 'Widow wins fight to bear child of dead husband' (Marks, 1997). Accompanied by a picture of a young woman holding a baby, demurely dressed in black, a cross dangling at her throat, this headline emphasized the theme of kinship triumphant: a line of descent continued by a wife's determination to press the family relationship beyond her spouse's death, the normal biological point of no return. Observers of British culture may, without too great a stretch, see here the recurrent trope of the family tragedy, a potent device for stirring and uniting the national imagination, whether averted, as in this case, or more commonly not (the Soham murders of 2002, Princess Diana's death in 1997, the novels of Dickens or the tragedies of Shakespeare).

The same story appeared in the American-flavored, international newspaper, the *Herald Tribune*, under the headline, 'In UK Court Case, Widow Wins Right to Use Spouse's Sperm' (Associated Press, 1997). Here, too, the verb 'wins' signaled a hurdle overcomed, but the *Tribune*'s subtext was quite different from the *Telegraph*'s. Flanked by the picture of a smartly dressed, smiling young woman leaving the courthouse, surrounded by photographers, the predominant theme in this rendition was the individual's victory over forces that sought to curtail her right, as an autonomous consumer, to use a desired commodity—in this case, the 'spouse's sperm.' Again, it is tempting to discern here some familiar elements of the American cultural landscape: the emphasis on the lawsuit, the individual's right of reproductive choice, and the commodification of the partner's sperm to satisfy that felt right. The baby born to the woman in *this* story would be, one senses, very much a product of her own desires, not, as suggested in the *Telegraph*'s account, the realization of a couple's shared but tragically interrupted dream of family life.

The subtle semiotics of newspaper headlines offers an entry point to a more general argument. Even the most basic processes of life—in this case, the union of egg and sperm to produce new offspring—can be read in the context of modern biotechnology as telling very different stories, with contrasting moral and ethical implications. Through its capacity to generate new forms of life, biotechnology renders unstable the received boundaries between the natural and the unnatural. Children, for instance, can be conceived when their biological father is no longer living—violating the ancient taboo against necrophilia and the modern

one against unconsenting parenthood. Complex social work, such as that done in Diane Blood's case by courts, fertility clinics, and daily newspapers, is needed then to reorder the instability, to put the new and potentially threatening entities and behaviors unchained by biotechnology back into places where they can be interpreted and controlled. Let us turn to a more detailed exploration of the ways in which biotechnology's ontological exuberance has been managed in the political cultures of Britain, Germany and the United States.

Abortion: high principles, mundane practices

Abortion, the intentional termination of pregnancy, is an ancient means of controlling reproduction through artificial means, but it achieved new political visibility and salience in the later 20th century following the development of technologically assisted contraception and the associated rise of the women's movement. Abortion can be seen as one of the earliest forms of biotechnology, albeit not one productive of life: in freeing a woman of an unwanted pregnancy, abortion necessarily denies existence to the developing fetus. Because of its implications for research on embryos and stem cells, the legal treatment of abortion is a necessary starting point for reviewing cross-cultural divergences in regulating biotechnology. As we shall see, disparate legal regimes have developed around abortion in three countries that differ in their understandings of the ontological status of the fetus, their definition of the pregnant woman's interests, and their positioning of the state's role.

In the United States, abortion law was federalized by the deeply divisive 1973 Supreme Court decision in *Roe v.* Wade (1973) and reaffirmed several times, most authoritatively in *Planned Parenthood of Southeastern Pennsylvania v. Casey* (1992). Casey left standing the core element of *Roe*—the recognition of a woman's constitutional right to have an abortion—but it also recognized that the state has an interest in protecting the life of the unborn, and that this interest can assume priority once the fetus becomes viable, that is, capable of surviving outside the mother's womb. As long as *Roe* and *Casey* remain the law, states may regulate abortions only to the extent that they do not infringe upon the fundamental right guaranteed by these decisions.

In Britain, abortion is regulated by the 1967 Abortion Act, which permits the termination of pregnancy under stated conditions related to the physical or mental health of the woman, the well-being of her existing family, or the risk of giving birth to a handicapped child. Though abortions require the consent of two physicians, many concede that the clause covering risks to the woman's health has been interpreted so broadly as to authorize, in effect, abortion on demand in England and Wales. A provision of the 1990 Human Fertilisation and Embryology Act reduced the time limit for permissible abortions from 28 to 24 weeks. This change reflected a firm medical consensus in favor of the lower limit, according to sources I consulted at the time, and it happened with barely a ripple of debate about women's rights or the ontological status of the embryo.

In Germany, abortion law was caught up in the broader politics of reunification after the fall of the wall between former East and West Germany. While the country was divided, a more liberal legal regime had developed in the east, allowing virtually unrestricted abortions during the early months of pregnancy. This arrangement ran up against the Constitutional Court's holding that, under Germany's constitution, the Basic Law, the embryo must be accorded full human dignity from the moment of nuclear fusion between egg and sperm. Politically, too, the notion of abortion on demand was anathema to Chancellor Helmut Kohl's ruling Christian Democratic government. Under a compromise whose terms were not fully worked out until after reunification, Germany retained the 19th century law that declared all abortions to be criminal acts punishable by imprisonment. At the same time, lawful exceptions were made for pregnancy terminations to protect the health of the mother, provided she underwent appropriate counseling and was certified as being in compliance with statutory requirements.

On the surface, then, all three countries made legal accommodations permitting women more or less liberal access to abortions during the first three to six months of pregnancy, but the underlying rationales were vastly different, as were the grounds for loosening earlier, more restrictive laws. Only Germany felt it needful to adjudicate the ontological status of the embryo itself; the American pro-choice movement resisted repeated attempts to write such declarations into US law, while in Britain no attempt was made to clarify this issue, and access to abortion was based, as in Germany, on considerations of maternal and familial welfare. Only in America, by contrast, was abortion treated as an extension of a woman's constitutional right to personal liberty, and hence absolutely protected for a time against state intervention. In both European nations, welfare state concerns for health and family provided the basis for crafting a rationale for abortions, under authority delegated by the state to the medical profession.

Assisted reproduction

The birth of Louise Brown, the world's first test-tube baby, through in vitro fertilization (IVF) in 1978 opened a new era in technologically assisted reproduction. Just as the advent of the birth control pill changed the social context for abortion, so IVF reframed discussions of the nature of kinship and family that had begun decades earlier with the growing popularity of artificial insemination as a treatment for male infertility. Only, whereas artificial insemination problematized the notion of fatherhood, now it was the mother's taken-for-granted relationship to her child that became destabilized, producing extended legal and social ripples. Those ripples spread in varying patterns across the cultural norms and institutional structures for regulating reproduction and the family in three nations.

Family affairs are matters of state law in the United States, and so the issues raised by IVF surfaced first in state courts and legislatures. Curiously, though, the first public trial of the meaning of motherhood in the era of assisted reproduction involved little if any high technology. This was the case of Baby M, a girl born

in 1986 in New Jersey to Mary Beth Whitehead, who had been artificially inseminated with sperm from William Stern. Together with his wife, Elizabeth, who for health reasons did not wish to conceive and give birth herself, William wanted to adopt the child that Whitehead, a married mother of two, carried to term. The case spilled into litigation when Baby M's 'surrogate mother' refused to give up the child and fled with her to Florida. Under court order, mother and daughter were returned to New Jersey, where the state's highest court held that the contract between Whitehead and the Sterns was unenforceable under applicable law and policy, but that the child's best interests demanded that custody be given to the Sterns.[3]

Since the mid-1980s, American women and their partners have experimented with many forms of IVF and surrogacy. Perhaps most controversial after Baby M was the use of so-called gestational surrogacy—a process in which an embryo created through IVF is implanted into a woman who carries the baby to term. In the widely discussed case of *Johnson v. Calvert*,[4] the California Supreme Court held that, in case of conflict, the couple intending to procreate, that, is the genetic parents of the child, would have priority over any rival claims of the gestational mother. In so holding, the court reinterpreted a provision of state family law that had defined a child's birth mother as its 'natural mother.' With this decision, California joined Belgium as one of the friendliest homes for uses of IVF and surrogacy. Couples wishing to have children may even contract with surrogates to carry children who are not genetically related to any of the parties to the agreement, although the California courts have ruled that the initiating couple may not thereby absolve itself of responsibility to care for the resulting baby.[5]

The value of IVF for prospective parents has risen with the development of prenatal diagnostic techniques that allow embryos to be screened for inherited genetic abnormalities and so be excluded from implantation. The same techniques can also be used to select embryos for sex and also for tissue matches with siblings in need of healthy bone marrow or other transplants. Under U.S. law, many of these services are provided in virtually unregulated fashion, with private clinics deciding which tests they will offer and to whom. Thus, sex selection to achieve 'family balance'—a euphemism for ensuring that couples will have the son or daughter they desire—is widely advertised by IVF clinics. In sum, U.S. law and practice treats a couple's desire to have children, and even children with certain predetermined characteristics, as the primary factor shaping the use and regulation of prenatal screening.

The contrast with Britain and Germany could hardly be starker, although the approaches taken in these two countries are not identical. In Britain, a 1990 law created the Human Fertilisation and Embryology Authority (HFEA) and charged it with licensing and monitoring all IVF and insemination clinics nationwide, as well as institutions undertaking embryo research and the storage of gametes and embryos. Issues such as prenatal screening or sex selection that are resolved in ad hoc and decentralized ways in the United States are subjected to central governmental control in the United Kingdom. Under this scheme,

physicians and prospective parents have less latitude to decide what testing or screening services will be made available than do private clinics in the United States. Embryos produced through IVF, but not implanted, are stored and used under HFEA guidelines pursuant to the HFE Act; these preclude, for instance, the removal of an unconsenting husband's sperm as happened in the Diane Blood case. Surrogacy is also regulated by law, and discouraged. While surrogacy agreements are not illegal, they are not enforceable, and it is a crime to advertise for a surrogate. In practice, this means that most surrogacy arrangements in Britain occur within the family, through agreements between close kin rather than strangers united by contract.

Germany in 1990 enacted what remains the most restrictive European legislation pertaining to assisted reproduction. Under German law, surrogacy is banned and all IVF embryos must be implanted in the woman who supplied the ova. Only as many embryos may be created as are actually implanted, and in no case more than three. Hence, the kinds of disputes that have erupted in other countries over the ownership, use and moral status of embryos are essentially precluded from occurring in Germany. The law acts in effect as an ontological prohibition, keeping entities potentially disruptive of the moral order from ever coming into being. Prenatal genetic diagnosis is also banned by law, reflecting a continued German anxiety over technologies that may allow the selection of human beings according to criteria of relative worth. This regime is the very antithesis of the American one in its resistance to experimentation with technologically mediated reproductive choices.

Three national responses to IVF and associated prenatal testing techniques show once again how uncertainty is handled differently by each country's regulatory apparatus. Decentralized decisionmaking and a market-based approach to testing have produced in the United States a particularly hospitable climate for trying things out, with boundary-testing actions preceding, and provoking, the making of normative judgments. Britain's approach is more restrictive in setting uniform national guidelines for all matters to do with the human embryo, so that technology unfolds under the state's watchful and politically self-conscious supervision. Germany has sought to maintain a state of perfect legal and ethical clarity, and it has done so by legislating against border-crossing ontologies that could create uncertainty through unchecked social and ethical innovation.

Stem cells

The early years of the 21st century ushered in a surprising debate in many industrial nations. The question was whether and under what conditions states should support research using embryonic stem cells. Derived from very early human embryos, these undifferentiated cells have the capacity to develop into many types of specialized cells that could potentially be used to treat diseases of the heart, brain, nerves, or other organs and tissues. By the turn of the century, many biologists regarded stem cell research as the most promising of all frontiers

in biomedicine. For the first time since the recombinant-DNA debates of the 1970s, however, governments hesitated to offer unrestricted support for a potentially revolutionary project in the life sciences. The reasons were closely tied to the framing of life itself as a political issue, and national policies toward embryonic stem cells diverged according to dominant framings in each country.

Michel Foucault famously called attention to the conversion of life, or *bios*, into the subject matter of political action, and more broadly governmentality, in modernity (Foucault, 1990 [1976], pp. 135–45; see also Agamben, 1998, pp. 1–8). But what would he have made of the strange forms that biopolitics took on the other side of an ocean at the dawn of a century he did not live to see? As deployed by the US religious right, the concept of 'life' is less an instrument for classifying or regulating populations than a device for keeping at bay unruly social movements or novel constellations of social life.

In May 2005, President George W. Bush threatened his first veto, noteworthy enough for a president comfortably in charge of the party that also controlled both houses of Congress. The subject was stem cells—a topic Bush had addressed in August 2001 at his first press conference as a first-term president. At stake was a congressional attempt to expand the domain of federally funded research on stem cells beyond the narrow limits laid down in 2001. The president had authorized research only with cell lines that existed before that date, and the number of available lines turned out to have been greatly overestimated. On May 24, the House of Representatives, by a vote of 238 to 194, expanded the zone of permitted research to include 'spare embryos' left over from IVF procedures, and the Senate appeared likely to follow suit. But Bush remained firm in his opposition, announcing a few days before the House vote: 'I'm a strong supporter of adult stem cell research, of course. But I made it very clear to the Congress that the use of federal money, taxpayers' money, to promote science which destroys life in order to save life, is—I'm against that. . .And therefore, if the bill does that, I will veto it' (Stolberg, 2005).

Presidential rhetoric, resting on the underlying calculus of interest group politics, here took over the philosopher's the work of ontological ordering. The newly popular trope 'science which destroys life in order to save life' implicitly casts the embryo, from the moment of fertilization, as a form of human life on a par with that of diseased adult patients. In using this language Bush and his supporters circumvented the decades-long legal battle to safeguard the *Roe-Casey* settlement that acknowledged women's constitutionally protected liberty rights without taking a stance on the biological status of the embryo. What had not been won in the courts by legal authority, nor indeed in biomedical research institutions under the authority of the life sciences, was thereby claimed as the victor's spoils of the electoral process. Fusing morality with the market, a presidential policy that most polls showed to be *inconsistent* with the majority's ethical wishes was presented as *consistent* with the majority's desire for wise stewardship of the taxpayers' money.

Britain's policy toward stem cell research, considered the most permissive in Europe, drew the ontological line around stem cells differently. Under the HFE

Act, research on embryos is permitted in principle until the appearance, at roughly 14 days, of the primitive streak, a thickened line of cells signaling the division of the embryo into recognizable right, left, front and back parts, as well as the formation of the central nervous system and major organs. In other words, British law for all practical purposes does not regard pre-14-day-old embryos as being biologically continuous with fully developed human life. Stem cells derived before this cut-off point in embryonic development are therefore lawfully available for research. After that date, sharp developmental boundaries are seen as harder to sustain and research on embryos is correspondingly curtailed. An authorized regulatory structure, the HFEA, offers public reassurance that the moral order will be maintained and that science, once embarked on manipulating life at the early embryonic stage, will not slide down the slippery slope to treating *all* life as subject to genetic modification.[6] As yet, public faith in the HFEA's capacity to carry out its delicate mission has not eroded, even though science's remit has already expanded beyond the bounds foreseen in 1990, for example, through the inclusion of entities created by procedures other than the fertilization of egg and sperm within the statutory definition of an embryo.

In Germany, constitutional law underwrote essentially the same ontological settlement that was politically endorsed in the United States by a Republican administration out to consolidate its conservative religious support. The developing embryo is entitled in Germany to be accorded full human dignity, but that status is achieved through the principled application of law rather than the vagaries of presidential politics. Although German law does not allow the creation or destruction of embryos for research, the Bundestag voted in early 2002 to allow the importation of stem cells from abroad if they had been created before a stated cut-off date. This condition fulfills the generally accepted dictum that no embryo should be expended for German research, since the pre-existing stem cells were clearly created without those needs in mind. As in the two other cases, a line is drawn between ethically permissible and impermissible research, but, in the German case, the morally relevant line is that between ethics inside and outside the nation, not between embryonic and adult stem cells as in the United States nor between the pre- and post-14-day entity as in Britain. Accepting human life as a transcendental good, Germany has ruled how scientists may manipulate its earliest manifestations. Germany cannot, of course, legislate the same morality for other nations, but it *can*, it seems, maintain an internal order that provides no incentives for others to act in ways deemed ethically unacceptable in Germany.[7]

GM crops

The political reception of GM crops, and by extension GM foods, in the three countries seems at first sight to turn the picture with respect to stem cells on its head. In this case, it is the United States that has provided the most hospitable home for innovation and commercial production, whereas Britain has been most reluctant to allow the technology to develop, with Germany positioned

somewhere between. But a closer look at each nation's accommodation with GM crops reveals underlying regularities.

By all reasonable measures, the United States is the world leader in the production and use of GM crops. US companies were prominently among the first to develop, test and market these plants. In 2000, barely five years after their first commercial introduction, the United States accounted for some two-thirds of the production of GM crops and almost 75% of the acres planted with these crops worldwide (Pew Initiative on Food and Technology, 2001). US research has continued to lead the search for new applications of crop biotechnology, for example, in designing a wave of 'agriceutical' products whose engineered properties straddle the line between conventional food and pharmaceuticals. Given the strong opposition to GM crops in Britain and elsewhere in Europe, as well as America's own history of concern about environmental and health risks (Brickman, Jasanoff & Ilgen, 1985; Vogel, 1986), many have wondered why the US public has greeted this new technology so complacently. Have Americans grown tired of being risk averse?

The answer, on examination, has less to do with public perceptions of GM products than with the state's reliance on and deployment of science as an instrument for quelling possible controversy. Early in the history of biotechnology, a convergence of views between university-based molecular biologists and corporate promoters of biotechnology led to the characterization of genetic modification as a process that should arouse no special regulatory concern. Under a 1986 White House policy known as the Coordinated Framework (Office of Science and Technology, 1986), US agencies decided to regulate biotechnology under a mosaic of existing laws that conferred, in the administration's view, adequate authority to ensure the safety of GM products. Modern biotechnology was represented for regulatory purposes as an extension of older techniques of biological manipulation, not as a radical break with past practices. To be sure, this position required advocates to maintain that the technology was at once familiar and revolutionary, a delicate balancing act that produced paradoxical sentences like the following from the Coordinated Framework: 'While the recently developed methods are an extension of traditional manipulations that can produce similar or identical products, they enable more precise genetic modifications, and therefore hold the promise for exciting innovation and new areas of commercial opportunity.' It was the theme of specificity, however, that carried the day for policymakers, overcoming arguments about unknowns and unknowables that might have justified a more proactive legislative response to biotechnology.[8]

British policies toward agricultural biotechnology were initially formulated along relatively permissive lines as in the United States, although experts in Britain were more cautious from the start about the environmental consequences of large-scale commercialization of GM crops.[9] The regulatory climate changed, however, in 1996. It was then revealed that the experts advising the Ministry of Agriculture Fisheries and Food had erred in predicting that 'mad cow' disease would not be transmitted from cattle to humans and had also

concealed their own uncertainties from the public.[10] In an environment of increased concern and distrust of experts, intensified by news flashes about possible health hazards from GM food, the British public massively turned away from these products, and the government realized that it had a crisis of confidence on its hands.

The state's response was to reconstitute the frayed institutions of governance that appeared to have lost the public's trust. This entailed, to start with, bringing a wider range of voices and opinions into the decisionmaking process, which the government proceeded to do first by constituting a new, broad-based advisory committee, the Agriculture and Environment Biotechnology Commission, and second by conducting, with the commission's assistance, a nationwide debate on the commodification of GM crops, entitled *GM Nation?* Shortly after that process, the government announced its first approval of a GM crop, a maize species modified to resist a chemical weed killer, glufosinate ammonium; two other GM crops were denied approval (Coghlan, 2004). Agricultural biotechnology companies, it seemed, had gained what they had wanted, but not on the terms they had successfully lobbied for in the United States. GM crop approvals would go forward much more cautiously in Britain, with a deeper, case-by-case exploration of uncertainties and greater sensitivity to possible adverse effects. Under such heightened scrutiny, there would clearly be no guarantee that crops deemed safe by US or other exporting nations would be accepted as safe for use in Britain.

The German response to GM crops produced no public outcry comparable to that in Britain. On this issue as in others relating to biotechnology, Germany sought to avoid controversy by opting for a legislative framework that reduced the risk of ontological mixing or impurity—thereby also minimizing the possibility of normative conflicts. Specifically, in June 2004 the Bundestag passed a stringent law on growing GM crops in Germany. Key provisions included restrictions on the amount of land to be planted with GM crops, a national register to keep track of these crops, and a requirement that farmers pay damages to non-GM growers whose fields are contaminated by GM varieties. The horror of unregulated things, so prevalent in the German legal order, came through in a parliamentarian's comments on the law: 'In the interest of farmers and consumers, we do not want genetically altered foods uncontrolled and initially unnoticed to sneak onto our grocery shelves' (Deutsche Welle, 2004b). It was perhaps a reaction, too, to the US situation, where polls showed that GM ingredients had found their way into the food chain without the knowledge or consent of most consumers.

Yet even the strictest of laws could not eliminate all unruly behavior. A German news service reported in May 2004 that unknown vandals had destroyed a research plot planted with GM crops in the eastern German state of Sachsen-Anhalt. In response, state authorities said that GM crops were being grown in secret on 29 plots throughout the country, but that the corn grown there would be used only in animal feed (Deutsche Welle, 2004a). Experimentation, it seemed, was not dead in Germany; only the conduct of it could not be disclosed by a government publicly committed to the ideal of transparency.

The politics of ontological ordering

We are now in a position to draw out some of the regularities in the three national responses to biotechnology, taking into account both the biomedical and the agricultural realms. Most generally, the differences seem to center on the institutional resources that each nation deploys in carrying out the task of ontological ordering that biotechnology, in its zeal for hybridity, inevitably requires. How should the novel entities produced through genetic and other biological manipulations be classified? Who will resolve the moral dilemmas associated with living things whose legal status is uncertain and whose impacts on the physical and social environment are impossible to predict with any certainty? In each country, questions such as these have arisen in connection with other technological developments, but perhaps never with quite the urgency generated at the fast-moving frontiers of biotechnology.

In comparing the three countries, we are struck first of all by the different degrees of tolerance for 'monsters,' or entities that threaten disorder by crossing the settled boundaries of nature or society. Experimentation, in human reproduction as well as in crop biotechnology, has been the order of the day in the United States, cautiously tolerated in Britain, and for the most part shunned in Germany. This variation in the acceptance of new entities—whether in kinship structures or in crops and food—is systematically linked to each nation's institutional arrangements for dealing with uncertainty. As summarized in Table 1 below, the American approach on the whole favors innovation and risk-taking, regulated by the laws of the market, leaving complaints and grievances to be sorted out after the fact by the courts. By contrast, both Britain and Germany have opted for more cautious legislative solutions, allowing innovation to proceed only within a normative framework arrived at by law. But whereas Britain countenances a certain amount of ambiguity, leaving it to expert bodies to offer case-specific clarification, Germany has preferred to reduce the scope of both administrative and technological discretion by crafting unambiguous and strictly enforceable legal norms. In Germany, if the laws are properly adhered to, there *can* be no ontologically confusing frozen embryos, nor GM crops that exist unrecorded, outside a national register.

TABLE 1. National strategies of normalization

US	*UK*	*GERMANY*
Monsters encouraged	Monsters permitted	Monsters forbidden
Market-regulated innovation	Expert-regulated innovation	Law-regulated innovation
Decentralized norms	Centralized norms	Centralized norms
Winner-take-all settlement of controversy	Consensual settlement of controversy	Reasoned (principled) settlement of controversy
Judicial accountability	Parliamentary and administrative accountability	Legislative accountability

Only the Bush administration's seemingly unshakeable aversion to embryonic stem cell research seems to counter the national drive toward biotechnological innovation in the United States, but what we see here is not an anomalous societal turn away from risk-taking. Patently, many Republicans, beginning with President Ronald Reagan's widow and including staunch conservatives like Senator Orrin Hatch of Utah, back a more relaxed approach toward stem cell research. They, like the majority of Britons, are prepared to accept early embryos as biologically and morally different from growing children and adult human beings. Not for them, nor for most Democrats, the easy elision of developmental and cognitive differences reflected in George Bush's reference to 'science which destroys life in order to save life.' Commonsensical empiricists in the Anglophone world, on either side of the Atlantic, find it difficult to equate a blob of cells on the point of a pin with a thirteen-year-old child suffering from juvenile diabetes or a 60-year-old victim of Parkinson's disease.[11]

In the US stem cell debate, one sees the laws of the market setting the high-visibility terms of national political ideology rather than the lower-order conditions for technological innovation. The exaltation of 'life,' be it in the four or five-day embryo or in a persistently vegetative woman kept 'alive' with a feeding tube,[12] is the discursive ploy of a president who failed to win the popular vote in his first term and won only a slim majority in his second. The administration's stance on this issue has less to do with the metaphysics or morality of borderline life forms than with the simple calculus of keeping a winning coalition in place. It is the expedient adoption of a rhetoric that plays particularly well to America's anti-abortionists, one of the coalition's most volatile, yet indispensable, components. In this case, it is important for those in power to sell the rhetoric of 'life' directly to their consuming publics, as a transcendental *political* commodity; that goal overrides a laissez faire economy's normal indulgence toward researchers and pharmaceutical companies who wish to sell a technologically configured and commodified 'life' to *their* markets, in the form of remedies for disease.

Concluding reflections

A decade ago, I wrote that policy institutions in the United States, Britain, Germany had chosen to frame the risks of biotechnology in different ways: the first as a stream of *products*, the second as a unique and innovative *process*, and the third as a collaborative *program* between science, technology and the state (Jasanoff, 1995). Ten years later, the further unfolding of politics and policy around biotechnology allows us to see with greater clarity how such framings of risk and safety are sustained in practice. In the United States, where the market is the dominant form of social ordering, it is no accident that biotechnology has been construed as a stream of products, the goods that the market is best positioned to deliver and regulate. In Britain, where the state regulates innovation by creating a shared empirical culture of taken-for-grantedness, it again seems natural to focus on, and be seen to master, a process that visibly remakes life in forms not yet well understood by experts or publics. And German attentiveness

to possibly dangerous programmatic alliances between technological innovation and the state is coupled to a postwar legal and political order that is exceptionally resistant to the idea of ungoverned or ungovernable spaces and to categories that defy the controlling capacity of the law.

Political culture, then, is intimately linked to the ways in which nations choose to govern the uncertainties that necessarily accompany technological innovation. Yet as I have suggested throughout this paper varying national approaches to regulation and control carry specific, non-negligible consequences for democratic politics. In particular, regulatory choices invariably affect the degree to which publics can unpack and deliberate on the underlying purposes of innovation. Which of the brave new worlds opened up by biotechnology are worth our collective investment? Which, perhaps, will produce lives we will regret living with, or living at all? These questions are not equally open for consideration in each of the three risk management regimes reviewed in this paper.

Not surprisingly, opportunities for deliberating on the aims of innovation have been most conspicuously absent in the United States, the country most hospitable to the fact of innovation. Farmed out to public intellectuals and, lately, to presidential ethics commissions of uncertain legitimacy and purpose, the task of reflecting on the directions of biotechnological advancement has largely been excluded from the public sphere. In Britain, the shock of the 'mad cow' crisis, coupled with turn-of-the-century pressures for political reform, converted expert ignorance and uncertainty into a more political issue than ever before. The result was a more thorough exploration of the environmental consequences of agricultural biotechnology and a higher standard of proof for GM crops and foods than in the United States. But questions of what *is* have to date occupied the British political imagination more than questions of what *ought* to be, and *GM Nation?* remains as yet an ad hoc experiment in deliberation rather than a marker of radical institutional change. Only in Germany has the temptation to privatize ethical deliberation been successfully resisted and the normative and political questions surrounding biotechnology have been extensively debated in the public sphere. But the response has been to erect high, some would say unacceptably high, barriers against social and technological creativity. Obsessed with the need for clarity, German institutions have displayed relatively little tolerance for the kinds of progress that may result from confronting disorder and learning systematically to accommodate it.

All this is consistent with the observation that human understandings of nature and social adaptations to nature are profoundly interlinked—indeed co-produced (Jasanoff, 2004). This deep interpenetration of the social and natural stands in the way of easy prescriptive solutions for the normative problems that confront us today in relation to biotechnology. Cross-national comparison may not alter that picture radically, since one can no more graft another nation's political forms onto one's own than successfully transplant pieces of human identity. Yet, to the extent that comparison enlarges our awareness of alternative possible worlds, it may aid the cause of reflection in a time of bewildering socio-technical change.

Notes

1. On the sociological process of framing, see Goffman (1974). Useful extensions of framing to domains of public policy may be found in Schon & Rein (1994), Medrano (2003), Jasanoff (2005).
2. In recent work, I have defined political culture as the 'systematic means by which a political community makes binding collective choices. The term encompasses structured modes of action, such as litigiousness in the United States, but also the myriad unwritten codes and practices with which a polity supplements its formal methods of assuring accountability and legitimacy in political decisionmaking. Political culture in contemporary knowledge societies includes the tacit, but nonetheless powerful, routines by which collective knowledge is produced and validated. It embraces institutionalized approaches to reasoning and deliberation. But equally, . . .political culture includes the moves by which a polity, almost by default, takes some issues or questions out of the domain of politics as usual' (Jasanoff, 2005, p. 21).
3. *In the Matter of Baby M*, 109 N.J. 396 (1988).
4. For an interpretation of the case, see Hartouni (1997), pp. 85–98.
5. *In re Marriage of Buzzanca*, 61 Cal.App.4th 1410 (1998).
6. On the UK debate over the slippery slope, see Mulkay (1997); see also Jasanoff (2005), pp. 155–7.
7. For a compelling ethnographic exposition of this argument, see Sperling (forthcoming).
8. For more on the problematic status of biotechnology's newness, see Jasanoff (2001), pp. 34–50.
9. For a more detailed discussion of this point, see Jasanoff (2005), pp. 56–8.
10. These failures were extensively documented in *The BSE Inquiry Report* (2000).
11. On the importance of visual perception in drawing ontologically significant boundaries, see Jasanoff (2005), pp. 152–5, 196.
12. The case in question was that of the brain-dead woman Terry Schiavo, which attracted extraordinary media and political attention in March 2005. By signing a bill allowing Schiavo's parents access to the federal courts, George Bush joined the fundamentalist Christian right in its ultimately unsuccessful attempt to keep Schiavo artificially fed and hydrated, as she had been for 15 years. Fascinating in its own terms, the case cannot be discussed in detail within the scope of this article.

References

Agamben, G. (1998) *Homo Sacer: Sovereign Power and Bare Life* (Stanford, CA: Stanford University Press).

Associated Press (1997) In UK court case, widow wins right to use spouse's sperm, *Herald Tribune*, February 7, p. 5.

Brickman, R., Jasanoff, S. & Ilgen, T. (1985) *Controlling Chemicals: The Politics of Regulation in Europe and the United States* (Ithaca, NY: Cornell University Press).

The BSE Inquiry Report (2000) (http://www.bseinquiry.gov.uk/) [accessed: May 2005].

Coghlan, A. (2004) Britain gives go-ahead for first GM crop, *New Scientist*, 9 March (http://www.newscientist.com/channel/life/gm-food/dn4754 [accessed: May 2005].

Foucault, M. (1990 [1976]) *The History of Sexuality*, Vol. 1 (New York: Vintage).

Goffman, E. (1974) *Frame Analysis: An Essay on the Organization of Experience* (Cambridge, MA: Harvard University Press).

Hartouni, V. (1997) Breached birth: Anna Johnson and the reproduction of raced bodies. In *Cultural Conceptions: On Reproductive Technologies and the Remaking of Life*, pp. 85–98 (Minneapolis, MN: University of Minnesota Press).

Jasanoff, S. (1995) Product, process, or programme: three cultures and the regulation of biotechnology. In Bauer, M. (ed) *Resistance to New Technology*, pp. 311–31 (Cambridge: Cambridge University Press).

Jasanoff, S. (2001) Ordering life: law and the normalization of biotechnology, *Politeia*, XVII(62), pp. 34–50.

Jasanoff, S. (ed) (2004) *States of Knowledge: The Co-Production of Science and Social Order* (London: Routledge).

Jasanoff, S. (2005) *Designs on Nature: Science and Democracy in Europe and the United States* (Princeton: Princeton University Press).

Johnson v. Calvert (1993) 5 Cal. 4th 84.

Marks, K. (1997) Widow wins fight to bear child of dead husband, *The Daily Telegraph*, February 7, p. 6.

Marris, C., Wynne, B., Simmons, P. & Weldon, S. (2001) *Public Perceptions of Agricultural Biotechnologies in Europe (PABE)*. Final Report of the PABE Research Project, Contract number: FAIR CT98-3844 (DG12 – SSMI), Lancaster University, December.

Medrano, J. D. (2003) *Framing Europe: Attitudes toward European Integration in Germany, Spain, and the United Kingdom* (Princeton, NJ: Princeton University Press).

Mulkay, M. (1997) *The Embryo Research Debate: Science and the Politics of Reproduction* (Cambridge: Cambridge University Press).

Planned Parenthood of Southeastern Pennsylvania v. Casey (1992) 505 US 833.

Office of Science and Technology Policy, Coordinated Framework for Regulation of Biotechnology (1986) 51 *Federal Register* 23302, 26 June.

Pew Initiative on Food and Biotechnology (2001) Genetically modified crops in the United States, Factsheet (http://pewagbiotech.org/resources/factsheets/display.php3?FactsheetID = 1) [accessed May 2005].

Roe v. Wade (1973) 410 US 113.

Schon, D. A. & Rein, M. (1994) *Frame/Reflection: Toward the Resolution of IntractablePolicy Controversies* (New York: Basic Books).

Sperling, S. (forthcoming) Reasons of conscience: Stem cells, bioethics and German citizenship. PhD dissertation, Princeton University.

Stolberg, S. G. (2005) In Rare threat, Bush vows veto of stem cell bill, *New York Times*, 21 May, p. 1.

Vogel, D. (1986) *National Styles of Regulation: Environmental Policy in Great Britain and the United States* (Ithaca, NY: Cornell University Press).

Welle, D. (2004a) GM crop trials underway throughout Germany, 5 May (http://www.dw-world.de/dw/article/0,1191060,00.html) [accessed: May 2005).

Welle, D. (2004b) Bundestag passes stringent law on genetically modified crops, 6 June (http://www.dw-world.de/dw/article/0,1240112,00.html) [accessed: May 2005].