Communication Theory

Fifteen: One

February 2005

Pages 78–99

Neil Gerlach
Sheryl N. Hamilton

From Mad Scientist to Bad Scientist: Richard Seed as Biogovernmental Event

In 1998, Chicago physicist Richard Seed's announcement that he would clone a human being set off an international media furor that revealed important insights into our understandings of biotechnology, scientists, and governmental regulation of genetic research. This study examines English-language media coverage of Seed over a 5-year period, tracing how his initial framing as a "mad scientist" was quickly contained and managed by the scientific community through his reframing as a "bad scientist." Amid media calls for a response from government regulators, it became apparent that the state has failed to adequately prepare itself and the public for the eventuality of human cloning, a failure of biogovernance. This article discusses how three tensions in current biogovernmental practice were made visible once Seed was read as a biogovernmental event.

> If not me, then someone else. If not now, then later. If not here, then elsewhere. ... A political group can only impede, it cannot stop.
>
> —Richard Seed ("Physicist Impossible," p. A3)

These are, simultaneously, the words of a boastful mad scientist, a scientific realist, and a policy maker's nightmare. These are the words of Dr. Richard Seed, the Chicago physicist who in January 1998 shocked the world by declaring he would soon open a clinic to clone human babies. Media around the globe responded with a flurry of coverage; as one commentator wryly noted, "For three days in January, Richard Seed was one of the most famous men in America" (Sternberg, 1998c, p. 06D). So, who was Richard Seed and what does his fleeting identity as a media event tell us about current understandings of biotechnology and genetic scientists, the mediation of those in our culture, and how biotechnology is being rendered an object of governance?

The son of a medical doctor who helped pioneer blood banking in the 1930s, Seed had a credible scientific education with three degrees from Harvard, including a doctorate in physics. His early scientific career had been uneven, as he moved from project to project and did not settle at a single institution. In 1970 he turned from physics to biology, founding Embryo Transplant Corporation, which sought to produce super milk-producing cows. After that project collapsed financially, he set up Fertility and Genetics Research Inc. with his surgeon brother, Randolph Seed, to offer commercial embryo transfers from fertile to infertile women. This project also failed when the technology was superseded by current techniques of in-vitro fertilization. He turned to the financial realm in the early 1990s, establishing a mortgage financing business, which was also unsuccessful. In 1998, he founded the Human Cloning Foundation and served as one of its directors, although he is no longer affiliated with the organization.

It was on December 5, 1997, at a symposium on fertility at the Kent School of Law that Seed first made his comments about baby-cloning clinics. However, it was not until they were broadcast on National Public Radio on Tuesday, January 7, 1998, that national and international media picked up the story. Seed claimed that he intended to clone a human baby, needed $2 million, and hoped to produce 500 babies per year at his clinic using the same technique that had been used to produce Dolly the cloned sheep. According to Seed, four childless couples had already volunteered to participate. As time passed, his audacious claims shifted. He had been roundly criticized for taking advantage of couples desperate for a child and responded by suggesting he would clone himself instead. His critics then labeled him an egomaniac, so he decided he would clone his wife, Gloria. The amount of money required grew as time went on, and he indicated a willingness to move his clinic to whatever jurisdiction would host it.

We examined the international English-language media coverage of Seed from December 1997 to January 2004 and found over 185 articles, editorials, and transcripts from print and broadcast media. Initially characterized as a "mad scientist" for even suggesting the possibility of human cloning, Seed was quickly rewritten as a "bad scientist," namely one working outside the mainstream scientific community. In this shift, we suggest, can be seen the containment of the risk of an unruly member by the scientific community. Even more significant than the transformation from mad to bad scientist, however, was the role that Seed played as a biogovernmental event. Biogovernance is the means by which biotechnologies are rendered objects of governance by a conjuncture of sociocultural processes and then managed accordingly (Gerlach, 2004). As a biogovernmental event, Seed invited a response from regulators, as

Dolly did before him. Yet, what became visible in the ensuing debate were the tensions, paradoxes, and limits of biogovernance as a governmental practice.

Richard Seed as a global media event crystallized a moment of high reflexivity toward science and, more particularly, toward scientists. A number of theorists of late modernity have argued that a significant part of a broader transformation to "risk society," is an increasing public reflexivity toward the authoritative status of science (e.g., Beck, 1992, 1999; Giddens, 1991, 2003). The inherent indeterminacy of science as a mode of knowledge production, its failure to deliver on its utopian promises, and its contributions to new global environmental, military, and medical risks have produced a condition of what Gerlach (2004) drawing on Giddens (1991) has called "ontological insecurity."

Hamilton (2003) has argued elsewhere that ontological insecurity is heightened with respect to biotechnologies for three main reasons. As Nelkin (1995) noted with respect to science in general, citizens' primary knowledge of biotechnology comes from the mass media and popular culture. The public lacks the scientific expertise to evaluate that information and counter it with other information. Second, the catchall term "biotechnology" often encompasses existing, emerging, and imaginary scientific techniques and technologies. As a result, the referent of biotechnology is always unstable, always emergent. Third, biotechnologies are disrupting some of what have been our most fundamental social categories and boundaries. The boundaries between human and animal, life and death, natural and artificial, reproduction and replication, which have previously come under theoretical challenge, appear now to be under material and symbolic assault as well.

The very scientists who are posing these challenges to traditional categories of human life remain the only authorities legitimated to interpret these same developments. Yet this authority depends upon a leap of faith by the public. The contingent nature of scientific knowledge and the limited access the public has to it, require a relationship of trust between scientific communities and members of the public. For that to be established, scientists must contribute to a sense of ontological security around new scientific developments by demonstrating that they are acting to manage their attendant risks. Scientists, therefore, have a role to play in public debate. They have a necessary politicized relationship with the public, one that often plays itself out in the mass media.[1]

The representation of scientists in the media has not received an overwhelming amount of academic attention. Unfortunately, the significant work of Goodell (1977) and LaFollette (1990) has not really been taken up within the broader field of science and media or the cultural studies of science. At the same time, the analysis of science in media, more gen-

erally, continues to be dominated by the public understanding of science (PUS) approach. In general, the PUS literature remains concerned with the accuracy of scientific information in the media and degrees of scientific literacy in the public. Science and media become reduced to the project of science communication as a pedagogical enterprise. Science is seen as a relatively homogenous, unconflicted body of knowledge that can be transparently transmitted to a waiting public. Despite some attempts to rethink these underlying assumptions (Lewenstein, 1995; Wynne, 1995), there is still a tendency to attribute public reflexivity toward science as an outcome of inaccurate or distorted scientific information from popular culture and media sources.

Nelkin (1995) offered one of the most comprehensive treatments of science in the media. Her focus was on how the two communities of science and journalism work to shape the agenda of public communication. She explored the influence of scientists on science journalism as they seek to control the language and content of press accounts and considered the sources of tension between science and journalism. In this vein, there are a number of interesting studies focusing on how biotechnology has been treated in the mass media (Brown, 2000; Conduit, 1999; Conrad, 1997, 1999; Einsiedel, 1992; Hopkins, 1998; Hornig Priest, 1999, 2001; Miller, 1995). In general, these works examine the representation of scientific knowledge, focusing on actual media practices, on audiences, and on the frames through which the representations are constructed. Often, however, the authors do not go on to link these practices or their individual case study to broader social or theoretical formations.

In the cultural studies of science, there is a shift away from science communication toward unpacking notions of science and the figure of the scientist. Although the mass media remain a somewhat understudied site of scientific cultural production, there is a growing body of work taking up genetic science, in particular, in popular and public culture. In their groundbreaking text, *The DNA Mystique: The Gene as Cultural Icon* (1995), Nelkin and Lindee treated multiple sites of discourse, drawing out a variety of themes in which the gene has been framed. In particular, they were examining the production of genetic essentialism. The role of genetic scientists, per se, is not something they took up to any great extent. Van Dijk's 1998 text, *Imagenation: Popular Images of Genetics*, explored changing public discourse about the gene since the 1950s, focusing primarily on science and business communication and to a more limited extent, some fiction and popular culture. It was Turney, in *Frankenstein's Footsteps: Science, Genetics and Popular Culture* (1998), who most directly contributed to a consideration of the biologist in mediated culture. He offered a three-part typology of the shifting

image of the biologist, suggesting that from the latter half of the 20th century, the scientist became more distant from everyday experience as scientific knowledge became more abstract. He, like Weingart et al. (2003), suggested that this reflects, in part, an ambivalence toward science, rather than an outright critique. Turney illustrated well the ubiquity of the Frankenstein myth in current representations of biotechnological science and scientists, highlighting modernity's profound ambivalence toward biology in general and the body in particular. Turney suggested, "The *Frankenstein* script has become one of the most important in our culture's discussion of science and technology. To activate it, all you need is the word: *Frankenstein*" (1998, p. 6).

Richard Seed as Mad Scientist

Dr. Seed looks like Hollywood's idea of Frankenstein, with a name to match. ("Science Leading," 1998, p. 12)

Whereas Richard Seed has been occasionally referred to in Frankensteinian terms (e.g., Williams, 1998, p. A15), he has also been frequently compared to Drs. Strangelove, Kevorkian, and Jekyll. In other words, Seed has been placed in the canon of real and fictional "mad scientists." The mad scientist as a cultural figure has seen some scholarly treatment, almost exclusively as he (and he is almost always a "he") is represented in literature and film.[2] The mad scientist as a trope offers comment on our society's relationship with science at any given historical period. For a majority of analysts, the mad scientist reveals our anxieties or fears about new and untried technologies and scientific methods (Haynes, 2003; Mulkay, 1996; Skal, 1998; Toumey, 1992).

Some scholars have gone further, however, to posit the mad scientist as a personification of a more fundamental critique of science. Toumey (1992) argued that the mad scientist offers an antirationalist critique of rationalist, secular science unaccountable to morality and broader social norms; further, mad scientist stories are a procedure for censuring scientists and scientific knowledge. Haynes (1995) suggested that we take comfort in scapegoating scientists. Tudor (1991) and Skal (1998) both explored the mad scientist in horror and science fiction films, but drew somewhat different conclusions in relation to the mad scientist's relationship with science. Tudor suggested that in periods that focus on the mad scientist as the cause of social disorder, he was treated as an individual, volitional actor. There are other periods, he went on to claim, when science itself was framed as the cause of the disorder.[3] Skal suggested, on the other hand, that the mad scientist figure may be more linked to our concerns with science as an institution. "Our prevalent,

hyperbolic image of the madly overreaching scientist may be a half-conscious balloon-popping response to the perception—correct or not—that too much of modern life is controlled by arrogant and irresponsible science-related structures and systems" (p. 27).

From the various reviews of the figure of the mad scientist in popular and public culture, we draw out a set of characteristics that define the archetype. The mad scientist is distinguished by his personal characteristics, his particular scientific practices, and the resulting knowledge claims. The mad scientist is an arrogant individual obsessed with knowledge, power, and/or notoriety. Often paranoid, he is characterized by his overwhelming hubris, which frequently takes the form of delusions of grandeur, including a God complex. He shows a lack of concern for the social consequences of his actions, feeling himself above or beyond conventional standards of morality.

The mad scientist works in secrecy, outside of mainstream scientific practice. As Weingart et al. (2003) suggested:

> A characteristic feature of the "mad scientist" film is the secret basement laboratory in which the illegitimate experiments take place. ... Dangerous research is taking place outside official institutions such as university laboratories and government facilities ... and hidden from the critical observation of the scientific community. Scientists working in their home basements are outsiders. They have isolated themselves from official science because they feel misunderstood, often because they are obsessed by their research, the quantifiable goals and methods of which they see justified by the expected success. (p. 284)

As a result of the personal characteristics of the mad scientist and his specific scientific practice, the knowledge that he produces is illegitimate, immoral, and often illegal. Rehmann-Sutter (1996) specifically defined this as "Frankensteinian knowledge," suggesting that it has four characteristics. First, it is knowledge to which humanity has no right; it violates moral boundaries and does not respect the difference between Man and God. Second, it can often be fatal. Third, as a result of the potential consequences, it ought not to be obtained. Fourth and finally, Frankensteinian knowledge is knowledge that, once obtained, might nonetheless improve the status of humanity in certain respects and might trigger a moral change (Rehmann-Sutter). Thus, the mad scientist as a cultural figure marks the boundaries of legitimate and illegitimate science, simultaneously offering ground for the critique of science, but often individualizing that critique to the particular scientist.

Many media titles in early January 1998 labeled Seed a mad scientist (e.g., Coren, 1998, p. 16; Life and Style, 1998a; Robertson, 1998). It was not only the media, however, that used this language, but also other

scientists (e.g., "Scientist Pushes," 1998), and even then-U.S. Health Secretary Donna Shalala (Rhodes & Macintyre, 1998). Other oft-repeated notions evoked madness, including "nutty" (Kirkey, 1999, p. A1), "eccentric" (Plans, 1998, p. A18), "clearly unhinged" ("Cloning Proponent," 1998, p. A13); and "fruitcake" (Weingarten, 1998, p. F01). The casting (and castigating) of Seed as a mad scientist did not end with labeling, however; in fact, he is robustly represented within the terms of the archetype we mapped above.

The media were very interested in Seed's personal characteristics and even his personal appearance. He was described as an "oversize man—who looks like an Old Testament prophet" (Nash, 1998, p. 58); he wore a beard; his clothes were mismatched and sloppy. His large, cumbersome, and untidy appearance was interpreted as a manifestation of his personal characteristics.

> Then, suddenly, the danger had a face. It was a scary face. Forbidding. Mephistophelean. Its eyes smoldered. When it spoke, it growled. For those who would want to demonize human cloning, this was too good to be true. The demon Seed. He was defiant, he was rude. (Weingarten, 1998, p. F01)

Seed was portrayed as holding many of the personal characteristics of the archetypical mad scientist. He was repeatedly represented as paranoid, unwilling to reveal the location of his research or the identities of his research subjects and financial partners. In a response to a request by a journalist for a progress report on his research, he replied, "The fewer people know what I'm doing, the better off we are" (Miele, 1999, p. 56). Other scientists were quick to dismiss him as someone obsessed with his own notoriety. For example, Lord Winston, the London-based fertility expert who helped produce the world's first test-tube baby, has been repeatedly quoted as saying, "My first reaction is that here is somebody who is trying to make a quick buck off of self-advertising" ("Cloning Proponent," 1998, p. A13). He is frequently accused of hubris, most notably in his decision to clone himself.

Seed clearly located himself outside traditional norms of morality. He saw himself as leading the cause for human cloning, referring to human dignity, for example, as "gibberish" and "nonsense" in response to his critics (Kirkey, 1999, p. A1). A God complex is apparent in his desire to eliminate death, produce the road to eternal life, and bring man into his proper role as creator of life (Coren, 1998; "Hello Dolly," 1998; Miele, 1999; Palmer, 1998; "Put Controls," 1998).

At times it seems as though Seed has deliberately courted the image of the mad scientist, being evasive in his answers, claiming god-like status, and associating himself with the Quebec-based cult, the Raelians, who

believe that human beings were cloned from aliens and who are actively pursuing human cloning projects in mysterious, off-shore locations. He has been repeatedly very open about his need for investment dollars and has made future claims that he knows cannot be scientifically justified at the present time. Yet, the issue is larger than Seed himself; he has been framed as a representative of our fears around human cloning. Kendall and Kotulak (1998) wrote:

> A week ago, Richard Seed was a broke, eccentric scientist winding down his career in lassitude, despite his own convictions about how smart he is. On Wednesday, his face, trimmed with a prophet's beard, was beaming around the globe via satellite as he uttered aphorisms about God, science and reproduction. Overnight, he had become the embodiment of the world's fears about human cloning. (p. H2)

These fears are not only abstract, but manifest in a fear of unregulated science. The *Montreal Gazette* reported:

> Mr. Seed embodies the spectre of uncontrolled technology in the hands of irresponsible people. Already fearful of cloning's potential for unspeakable misuse, people now see in the person of Mr. Seed an unholy combination of greed, vanity, and insouciance. They are rightly alarmed. ("Human Cloning," 1998, p. B2)

At first glance, it might seem odd that such a quirky man, making a completely unsubstantiated and grandiose claim, could cause such a media furor. The appearance of Richard Seed, we argue, catalyzed a set of public fears that were already present (at least since the cloning of Dolly). This reflexive context preexisted the appearance of Seed. These public concerns are then easily mapped onto a regularity as well known as the mad scientist—Seed becomes Frankenstein. However, it is not that simple. Although the discourse of Richard Seed as mad scientist has considerable rhetorical flare, enabling such wild claims as, "Seed and Kevorkian are the Bobbsey Twins of our moral disorder" (Elshtain, 1998, p. 9), it is not the only framing of the scientist at work in the public discourse. A second, and we suggest, more powerful discourse is also present: Richard Seed as "bad scientist."

Richard Seed as Bad Scientist

> I think he's [Dr. Seed's] important to us because he shows us what people are afraid of—a mad scientist jumping up and saying, "I don't care what you say, I'm going to clone"—We don't know if he's a mad scientist. He has no money, he has no credentials, he has no scientists who say they're working with him. But the idea that somebody could jump up and say, "I don't care what you say, I'm going to do it" I think frightened the world, whether or not he actually is the one who could do anything. (Gina Kolata in Pringle, 1998)

One of the consequences of the mad scientist trope, as a number of scholars have noted, is that it opens the door to a broader critique of science. This risk was contained, in part, through the second discourse running through the coverage, and that is the "defanging" of Seed through his characterization as merely a bad scientist. This was achieved through close attention to his troubled personal, and erratic professional, life. "What some had initially feared was a real-life science fiction horror story is now looking more like a sad comedy" (Kendall, 1998, p. A43).

Once again Seed was described disparagingly, only this time it is not his sanity in question, but his credibility. He is labeled an "oddball" (Kendall, 1998, p. A43), a "penniless scientist" ("Medical Experts," 1998, n.p.), a "repellent self-publicist" (Gurdon, 1998, p. 22), "greedy" ("Medical Experts," 1998, n.p.), an "entrepreneur" (Sternberg, 1998a, p. 01A), as engaging in "showboat science" (Hilton, 1998, p. A26), and repeatedly as a "rogue" or "maverick" physicist.

In dramatic contrast to the press treatment of Ian Wilmut—the lead scientist on the team that cloned Dolly—about whom the public learned very little, Seed's personal life received almost as much attention as his professional credentials. Readers were repeatedly told about his three marriages, his failed companies, the foreclosure on his $333,000 loan, his eviction from his upscale home and relocation to a modest bungalow, and his $27,000 debt for federal back taxes (e.g., Kendall & Kotulak, 1998, p. H2). "Who is Dr. Richard Seed, the man some are calling a mad scientist? Well details are emerging about a history of financial problems and one scientific failure after another" (Rinaldo, 1998). This exposé of the person suggests that someone who cannot manage his personal life and finances is incapable of responsible scientific practice.

The primary focus, however, was on Seed's uneven and scattered professional career. Journalists paid close attention to the reaction of the broader scientific community to Seed. A near-litany emerged of his professional shortcomings: He had no funding, he had no formal training in molecular biology, and he had no institutional affiliation. Examples abound. "Seed has no medical degree, no laboratory backing, and little money, so many scientists aren't taking him seriously" (FDA, 1998) suggested a news wire, while another journalist wrote, "Dr. Seed failed in a 1984 attempt to set up fertility centers. He has no specialized knowledge of cloning research. The chances are slim indeed that he will be able to raise money and equip a clinic and recruit scientists and physicians to work there amid charges of irresponsibility and unethical practice" (Gough, 1998, p. 13A). *The Washington Post* claimed, "By and large, the scientific community has been contemptuously dismissive of Richard Seed, a research scientist who has gone ten years without a significant research project" (Weingarten, 1998, p. F01). His appeal for

funds was viewed as vulgar: "Scientists poured scorn yesterday on an appeal by a physicist for 1.3 million pounds to set up the world's first clinic to clone humans" (Sapstead & Highfield, 1998, p. 01).

Most significant to the effective characterization of Seed as a bad scientist, was his marginalization from his community of peers. He was reported as being "disowned" by the scientific community (Ruane, 1998, p. 11), and experts in the field were said to have reacted with "immediate revulsion" to his claims ("Cloning Proponent," p. A13). He was described as a loner (Wadman, 1998, p. A18) and a freelancer (Varadrajan & Murray, 1998, p. 1). Visible scientists from the Dolly media event were inevitably asked to comment on Seed's claims. Dr. Lee Silver labeled Seed as "seriously nutty" (Kirkey, 1999, p. A1), and Ian Wilmut dismissed him contemptuously: "He's just a silly old man" (Ballantyne, 1999). The media sought out comments from scientists who were once his colleagues, and overwhelmingly they were quick to distance themselves from Seed. For example, an Australian scientist is quoted as saying, "Everyone in the science area would avoid them [Seed and his brother] like the plague, really. They've been involved in fringe activities over the years" (Dow, 1998, p. 6).

The comparison of choice was with Ian Wilmut. Wilmut was the staid, plodding Scottish farmer who took an animal husbandry approach to the science of cloning, versus the American maverick and entrepreneur cloning human babies for profit. "It is, fortunately, highly unlikely that Dr. Seed will clone anybody. ... And perhaps because [cloning] research is led by the eminently sensible and British Ian Wilmut, intellectual parent of Dolly the cloned sheep, the implications seem considerably less frightening" ("Science Leading," 1998, p. 12). There is an express contrast between the bad and the good scientist. The bad scientist works alone, without peers, unable to obtain funding, without institutional endorsement, and for rewards in the press and the marketplace. The good scientist, on the other hand, works with a team, circulates his or her research in peer-reviewed venues, has research funding from the public and private sector, is affiliated with high profile institutions, and quietly pursues research for the greater good of humanity. A good researcher, like Wilmut, self-imposes limits on his scientific pursuits—Wilmut favors a ban on human cloning, whereas Seed does not (Evenson, 1999, p. A1; Healy, 1999, p. 176).

Through reference to normal scientific practice and the scientists who represent it, Seed was marked as an outlier. In this way, the potential critique of biotechnological science was defused. Science, in fact, operated as it should. If a scientist does not meet the requirements for rigorous scientific method, he is not respected within the community, not funded, not hired, and so on. Seed was far less threatening as a bad

scientist who has been pushed to the margins by fully functioning scientific norms and institutions than as a mad scientist. A bad scientist remains under the control of the scientific community, whereas a mad scientist, working in secret, does not.

Predictably, Seed's fame faded fast. As time progressed, he was increasingly framed as benign. When considering the more scientifically credible claims of Italian fertility specialist Severino Antinori in relation to human cloning, one journalist asked: "Meanwhile whatever happened to the last scientist who said he was going to clone humans just last year? Where is Dr. Richard Seed today?" (Jansen, 2001, p. 13). Seed became a point of reference, a figure for comparison, but not a real scientific concern. "Dr. Austin Smith (a stem cell researcher) is described as a respected academic on a modest university salary, not a commercial publicity seeking 'baby maker' like Richard Seed" (Ballantyne, 1998, n.p.).

Although not a risk to actually clone a human being, Seed was acknowledged as having opened up an important debate. "Why is it that the biggest debates on bioethics tend to be triggered by oddballs? In early 1998, eccentric physicist Richard Seed ignited a furor when he vowed to clone a human being. (He hasn't been heard from since)" (Lemonick, 1999, p. 56). Now that he was no longer a mad scientist, he was acknowledged as being a leader in considering the issue of human cloning:

> Yet few believe Seed can do it. He's a loner without the necessary know-how, skills, or financial backing. But equally, he couldn't be dismissed as a mad scientist. Even if he was exaggerating his own prowess, he was drawing to public attention the fact that human cloning is feasible—and perhaps not very far away. (Wadman, 1998, p. A18)

More importantly than opening up a general public debate, we suggest, Seed opened up a biogovernmental debate. For it was not only pundits and the scientific community that responded to his remarks; governments around the world were caught off guard by Seed's claims and hastened to produce a coherent governmental response.

Richard Seed as Biogovernmental Event

Richard Seed personified, we argue, a dramatic failure in risk management by Western governments. Increasingly, the activity of governance is focused on managing and alleviating public anxiety with respect to the risks of the future attendant upon global technical systems. This is a necessarily future-looking activity, with the risks of the future being controlled through the mobilization of strategies and techniques in the present. Biotechnology, as a new, ill-defined, and category-breaching

domain of technoscience, is particularly risky. Gerlach has argued that what emerges from this context are modes of governance targeted specifically toward the management of biotechnological risks (2004). Currently states are engaged in developing an emergent governmental rationality that he describes as biogovernance. In the case of Seed, there was very little direct regulation aimed specifically at human cloning. Seed stepped in to fill that gap, at least symbolically. Governments clearly had not anticipated that this issue would be a scientific potentiality so soon. They had not adequately anticipated the risk. In this way, Seed became an interesting biogovernmental event.

Biogovernance

At the intersection of risk society and biotechnology, biogovernance encompasses a set of management techniques aimed at the risks of biotechnology, whose outcome is the transformation of biotechnology into an object of governance. Gerlach argued that there are five broader social processes that enable the emergence and operation of biogovernance. Although these are not unique to the biotechnological arena, they play themselves out there in specific ways. The five processes include privatization, politicization, objectification, normalization, and responsibilization.

Privatization prescribes the location and management rationality of genetic research and development. Developing almost exclusively within the private sector, it has resulted in an increasingly concentrated multibillion dollar genomics industry that operates almost exclusively in secrecy. This secrecy is enabled by the scientific and legal mechanisms of bioprospecting and biopatenting, respectively.

Second, politicization is a mode of conflict containment. As a result of reflexivitiy and ontological insecurity, various interest groups seek to challenge the authority of bioscience. These conflictual processes are characterized by the absence of an appropriate forum for negotiating them and often play out in incompatible language games. For example, social movements employ a language of natural rights, whereas the biotech industry and government deploy a language focused on the diffusion of responsibility for risk. The absence of formal governmental venues means that these conflicts often play out in the courts and the media.

Third, objectification denotes the epistemological production of the gene as a field of management and includes practices such as mapping, testing, coding, banking, simulating, and representing. There are a number of implications to objectification. New biotechnologies promise to bridge the divide between nature and culture by subjecting both to the same industrializing techniques. The resulting epistemological frame can be described as a "molecular optic," to borrow Novas and Rose's term (2000), which distills complex behaviors into a singular logic of information.

The fourth condition of possibility of biogovernance is normalization. Normalization is a cluster of practices aimed at managing public discussion around biotechnology, rendering it legitimate, normal, and secure. Rather than politicization, which occurs once a conflict has emerged in the public sphere, normalization is a strategy aimed at controlling meaning-making before it produces conflict. It includes specific techniques of expert and public consultation, social marketing, and legislating. Authorities attempt to produce an ethos of biotechnological optimism, the effects of which include frames for understanding social impacts and limiting public debate.

Privatization, politicization, objectification, and normalization combine to produce the fifth condition of possibility of biogovernance: responsibilization. Responsibilization operates to individualize social responsibility for managing the risks of biotechnology. Increasingly, individuals are expected, not to discipline themselves, but to manage themselves and the risks that they pose to the wider social good, through accessing and mobilizing the resources and expertise at their disposal in the genetic marketplace. The material body is increasingly rendered irrelevant; what is important is the control of one's genetic information. The resulting form of genetic subjectivity does not necessarily lead to fatalism, but rather to an imperative to act in the present to manage future risk.

In many ways, Richard Seed was a logical outcome of these biogovernmental conditions. The privatization of science and its attendant secrecy allow or even encourage individual scientific entrepreneurs to work at the boundaries of the vision of the scientific community, governments, and the public.[4] The absence of a more formal political forum moved the debate to the media, complete with all the shortcomings that this site entails. The short life-cycle of issues of front-page news discourages a robust public consideration of the issues. In part for this reason, concerns about the objectification of the human play out primarily in the comments of bioethicists and antiabortion advocates. Clearly, the meanings around human cloning had not yet settled. Authorities—governmental, industrial, and scientific—had not successfully normalized the idea of human cloning. As a result popular culture motifs filled in the gaps in meaning, resulting in the initial mad scientist discourse. This unruliness of Richard Seed as a biogovernmental event suggested that responsibilization was not yet a completed process; as a result, responsibility for the risks of human cloning could not yet be downloaded onto the individual. Scientists and governments were actively involved, we demonstrate in the subsequent sections, in the negotiation of human cloning as a biogovernmental object.

Calls for a Response

Almost immediately after Seed's claims were widely reported, the media coverage was saturated with calls for a biogovernmental response from the state. The media expressed concern over both the absence of legislation in this area and the lack of clarity in existing regulation (e.g., Gough, 1998). In some reports, this took on almost crisis-level proportions.

> It now appears that these fears [of human cloning after Dolly] were no false alarm, and if Dr. Seed—even the name sounds sinister in this context—is ready to proceed with his hideous project, most scientists must have known they were not. In the absence of law, there is nothing to stop him. (Oleson, 1998, p. A10)

Calls quickly emerged for the American government to fill this lacunae. One reporter described Seed's public emergence as both a "warning and an invitation" (Dionne, 1998, p. A15). The *Los Angeles Times* suggested that Richard Seed was "just the kind of brash scientist that the federal government needs to rein in with legislation" ("Confronting," 1998b, p. B7). *The Economist* asserted that the regulatory issue was not that complicated: "For the moment, deciding what to do about the Mr. Seeds of the world is simple enough. That is because the technique is not yet safe. ... Mr. Seed and his imitators should be made to wait" ("Fear of Cloning," 1998, p. 18). Experts echoed the call for a governmental response—well-known bioethicist Arthur Caplan was quoted as saying, "One thing Richard Seed may have done is persuade people inadvertently that if the deviant and the oddball are going to get anywhere near human cloning, we need a temporary ban to make sure it is minimally safe before we try it in humans" (Sternberg, 1998b, p. 01A). A sense of urgency for policy intervention emerged.

Answering the Call

> So it was that when, in a quiet news period, he [Richard Seed] repeated his plans for a franchised chain of cloning clinics—outside U.S. jurisdiction if necessary—all hell broke loose. People queued up to condemn him, with President Bill Clinton at their head. ("Science Leading," 1998, p. 12)

In response to the cloning of Dolly in 1997, President Clinton had already banned the use of federal money to experiment with human cloning. He again waded into the rhetorical arena, with the unusual move of taking on Seed directly in the press. The statement of White House Press Secretary Mike McCurry circulated widely: "The scientific community ought to make it clear to Dr. Seed—and I think the President will make it clear to Dr. Seed—that he has elected to become irresponsible, unethical and unprofessional should he pursue the course he outlined" (e.g., "Plans," 1998). In his weekly radio address in early Janu-

ary, Clinton did not name Seed, but talked extensively about the risks of human cloning in a thinly veiled response to the uproar.

International governments were also quick to respond to the threat. Shortly after the broadcast, France's Jacques Chirac called for an international ban on human cloning. Nineteen European countries were quick to sign up. The signatories were Denmark, Estonia, Finland, France, Greece, Iceland, Italy, Latvia, Luxembourg, Moldavia, Norway, Portugal, Romania, San Marino, Slovenia, Spain, Sweden, Macedonia, and Turkey. The proposal was not signed by Germany, which claimed its own laws were stronger, and England, which did not want to restrict its research possibilities, but also claimed stronger domestic regulation. This followed previous international initiatives, but was much more direct, inviting a legislative commitment to controlling the risks of human cloning.[5]

While the executive levels of Western governments fought the rhetorical battle in the press, the U.S. Congress labored over a more legislative biogovernmental response. Seven different anticloning proposals emerged in the Senate alone. The initial bill, sponsored by the Republicans and supported by the National Right to Life Committee and the Christian Coalition, went to the floor on February 3, 1998, as an emergency measure without a committee hearing. By this time, the scientific community had mobilized. Worried about hasty and unduly limiting legislative responses, 71 patients' groups and scientific organizations, as well as 27 Nobel laureates lobbied hard opposing the bill. Despite overwhelming opposition to human cloning on Capitol Hill, and despite the early predictions that the bill would pass quickly, 12 Republicans joined all the Democrats and the bill failed, 18 votes short of the 60 required to bring it to a vote. What ensued is an ongoing process of the Senate approving a bill that did not pass in the House of Representatives and vice versa. Ultimately the United States remains without comprehensive federal legislation on the issue of human cloning. This lack of success in legislating the issue is in part due to the lack of clear lines of governmental authority over human cloning. Although the federal Food and Drug Administration intervened in mid-January 1998 to claim authority over clinical research using cloning technology, the consensus seems to be that the FDA, given its discretionary powers and noncriminalized sanctions, is not a strong enough governmental agency to effectively govern the issue. The debate appears to have moved to state legislatures where regulations are uneven, unclear, and generally perceived as weak.

As a biogovernmental event, therefore, Richard Seed had the potential to cause significant public anxiety. As a result, legislators had to both act, and be seen to act, in order to manage that risk. As Republican Senator Bill Frist said, "Our job is to stop Dr. Seed dead in his tracks,"

(Gugliotta, 1998, p. A04). They attempted to do so, and failed. However, this time, because Seed was a rhetorical threat only, this rhetorical response sufficed. Yet this near failure of biogovernance is revealing.

Implications of Richard Seed as Biogovernmental Event

A number of biogovernmental implications become visible from the case of Richard Seed. First, governments were caught off guard in anticipating the currency of the risk of human cloning, and this was widely recognized by the press (e.g., Ruane, 1998). Second, the scientific community was effective, on short notice, in complexifying and ultimately forestalling the state-authored biogovernmental response. Dionne (1998) noted:

> Fortunately, Richard Seed's proposal to begin cloning a human being presents us with an easy case. Most scientists think it's irresponsible to start cloning people now because the technology is so untested. The scientific community was out in droves as soon as Seed made his announcement, warning of all the dangers and issuing thoughtful denunciations. (p. A15; see also Chen, 1998a, p. A1)

All branches of the U.S. government attempted to regulate cloning in some way, primarily through marking it as a forbidden zone. Yet its forbidden nature resulted more from the temporal lag in governmental regulation than from any ontological or moral claim. In its haste, the government did not consult with scientific expertise and consequently failed to be effective. The scientific community mobilized, benefitting from considerable credibility in the media and in governmental circles, and as a result was successful in producing a discursive distinction between reproductive and therapeutic cloning.[6] Therapeutic cloning was rendered scientifically legitimate and nonthreatening, whereas reproductive cloning was relocated back into the future as a problem to be addressed later. The most effective governmental actor in this scenario is not the state, but rather, the scientific community, illustrating that biogovernmental authority is always a contested site.

The third implication of the Richard Seed event is that it revealed three fundamental and underlying tensions in biogovernance as a current governmental practice. First, biogovernance cannot be contained by national governments; it is an activity whose edges are always fraying. Biotechnologies simultaneously benefit from, and disrupt, the nation-state and its power to regulate economic and scientific activities within its borders. Richard Seed repeatedly claimed that if human cloning was made illegal in the United States, he would merely relocate "offshore," possibly to Mexico, Japan, Korea, and some undisclosed loca-

tion (e.g., Carney, 1998; Hourigan, 1998; Krieger, 1998). In the threats to move offshore, the secret basement laboratory of Weingart's mad scientist goes global (2003). However, aided by the privatization of science and global flows of capital and research, a number of American scientists had already moved to Britain, where regulations with respect to genetic research are less strict. These relocations are outside the governmental reach of the American state. Biogovernance increasingly will require international cooperation in order to be effective.

Second, human cloning put fundamental issues of human morality on the governmental agenda. Most, if not all, biotechnological issues contain similar moral dilemmas. As one journalist correctly noted, "That such a once-popular proposal [Clinton's 5-year plan] has been mired in controversy reflects the fundamental difficulty Congress faces in grappling with complex scientific issues that have a profound moral dimension—namely when does life begin?" (Chen, 1998b, p. A1). Current neoliberal governance is focused increasingly on the mobilization of a technical and economic rationality. One of the most common implications of this is the withdrawal of the state from the marketplace. We see a decline in the willingness of states to regulate the private sector. This has, in recent years, been the case in the biotechnological realm as well.[7] However, because the biotechnological realm is simultaneously industrial and moral, it poses a governmental dilemma. There remains a residual public expectation that the state will defend the moral boundaries of the national body and the bodies of its citizens, and yet when those boundaries are being breached by the private sector, and in particular, the scientific private sector, governments are frozen into immobility at worst, and ineffectiveness at best.

In addition to a promarket ideology that renders it difficult to regulate the private sector, there is also the ideological power of science and technology itself causing a third tension in any biogovernmental project. Journalists Spears and Laucius (1999) framed this issue well when they wrote: "Despite the ensuing criticism, Mr. Seed shows that once a new technology arrives, all the ethicists and law makers in the world can't stop people from trying to push it to its extremes" (p. A1). There is a general sense of resignation within the media coverage, among legislators, and on the part of scientists that human cloning is inevitable and ultimately unstoppable. "Depending on who's talking, Mr. Seed is either seriously 'brilliant' or 'seriously nutty.' But one thing is clear. He's not alone in believing human cloning will occur faster than anybody thinks" (Kirkey, 1999, p. A1). This technoscientific determinism renders any governmental response always already obsolete and therefore inevitably ineffective.

Conclusion

As a mad scientist, Seed works to remind us of the dangers not only of privatized science, but also of a singularly scientific worldview:

> The real scientist professes to be motivated by the rational, objective pursuit of knowledge; his mad counterpart, like the fool in a king's court, has the license to speak more plainly of his motivations, which can constitute the spectrum of human venality, with a special emphasis on power. (Skal, 1998, pp. 315–316)

However, the power of science that Seed momentarily made visible, was quickly moved back into the shadows through his reformulation as bad scientist. Ultimately, the Richard Seed event located the risk in the individual and not in the practice of science. Human cloning is not the problem, but rather the unskilled and unethical application of human cloning techniques by unscrupulous scientists. Science convinced government in this instance that science itself is best placed to govern these issues, complicating traditional structures of governance.

As media event, Seed works to normalize human cloning. Through the calls for and temporary bans being put into place, the risks of reproductive human cloning are relocated from the present, where Seed temporarily actualized them, into the future. Time is purchased for a more effective biogovernmental response, both on the part of the scientific community and national governments. Seed drew out into the open the public fear on this issue; our initial repugnance is now spent. Perhaps this is why subsequent forays into human cloning on the part of Drs. Severino Antinori and Panos Zavos, have not drawn the same kind of media or governmental responses. As Seed himself observed, "New things of any kind, mechanical, biological, and intellectual, always tend to create fear. ... But over time they become tolerated or ignored, and finally endorsed" (quoted in Brown, 1998, p. 10).

The tensions that are always present within biogovernance as a governmental rationality, became rupture points in the case of Richard Seed read as biogovernmental event. The contradictions inherent in the regulation of activities that are simultaneously national and global, in the state regulation of the private sector and its marketplace, and in the interference in scientific practice (read progress), render biotechnological science almost ungovernable in the traditional sense. Rather, governance becomes a process that is diffused among a range of social actors and involves an expanded variety of governmental techniques. The end goal of biogovernance as a specific mode of governmentality is not regulation or control, but rather the communication, management, even husbandry of biotechnological developments.

So, what does the future hold? The indeterminacy that we can see in Richard Seed as a biogovernmental event led to a continued ontological insecurity that is difficult to satisfactorily address. It seems inevitable not only that human cloning will happen, but also that there is nothing to stop maverick scientists from practicing it. Traditionally, the public has looked to the state to harness science in its service, enforce social norms in research and development, and ensure that technoscientific developments are for the social good. However, the emerging biogovernmental order seems unwilling and unable to meet those expectations.

Authors

Neil Gerlach is an assistant professor in the Department of Sociology and Anthropology at Carleton University. He thanks the Social Sciences and Humanities Research Council of Canada for its generous financial support of his biotechnological research. Sheryl N. Hamilton is the Canada Research Chair in Communication, Law, and Governance at Carleton University with dual appointments to the School of Journalism and Communication and the Department of Law. She would like to thank the Social Sciences and Humanities Research Council of Canada for its generous financial support of her research and her two invaluable research assistants, Christiana Abraham and Paula Romanow.

Notes

[1] This increased recognition of the importance of the media in relation to public opinion about science and the resulting increased participation of scientists in mediated science can be seen in the rise of scientist-spokespeople, communications wings of scientific organizations, university communication departments, and so on. See discussion of this by both van Dijck (1998) and Nelkin (1995), among others.

[2] The mad scientist has received significant attention (Gomel, 2000; Haynes, 1994, 1995; Mulkay, 1996; Rehmann-Sutter, 1996; Skal, 1998; Toumey, 1992; Tudor, 1989; Turney, 1998; Weingart, Muhl, & Pansegrau, 2003).

[3] His three periods are these: 1931–1950, The Secret of Life; 1951–1964, The Price of Progress; 1977–1984, Altered States. It is unfortunate that Tudor's typology (given its date of publication) cannot comment on the ensuing 20 years of films featuring mad science. If we were to add a fourth period, it might be the threat of private science (not linked to the authority of the state, military, police, and so on, but to capitalist enterprise), thinking here of films such as *Sixth Day* and *Gattaca* (1997).

[4] It is important to note that Dolly was also produced under a cloak of scientific secrecy and that this is increasingly the norm. It is ironic that it then served as a basis for marginalizing Seed.

[5] On November 11, 1997, a UNESCO meeting unanimously adopted the Universal Declaration on the Human Genome and Human Rights, which prohibits human reproductive cloning as contrary to human dignity.

[6] In layperson's terms, therapeutic cloning refers to cloning of cells for the purposes of producing body parts, tissues, organs, etc. In general, the immediate medical benefits of this type of cloning seem clearer, and it is more widely accepted. In contrast, reproductive cloning results in a complete organism produced through techniques such as those used in the creation of Dolly. The medical and social benefits of this type of cloning are less apparent, and it was the focus of the criticism in the Seed case.

[7] We can see the self-removal of the state from the regulation of certain biotechnology issues in the expansion of patent rights in various levels of organisms from bacteria to complex mammals.

References

Ballantyne, A. (1999, May 16). Fathers and clones. *Sunday Times—London*, n.p.
Ballantyne, A. (1998, November 29). Life in his hands. *Sunday Times—London*, n.p.
Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
Beck, U. (1999). *World risk society.* Cambridge, UK: Polity Press.

Brown, B. A. (1998, February 11). The cloning debate reveals our moral feebleness. *Asian Wall Street Journal*, p. 10.

Brown, N. (2000). Organising/disorganising the breakthrough motif: Dolly the cloned ewe meets Astrid the hybrid pig. In N. Brown, B. Rappert, & A. Webster (Eds.), *Contested futures: A sociology of prospective techno-science* (pp. 87–108). Aldershot, UK: Ashgate.

Carney, D. (1998, February 15). Human cloning stalled by politics. *Halifax Daily News*, p. 61.

Chen, E. (1998a, January 11). Clinton urges quick ban on human cloning. *Los Angeles Times*, p. A1.

Chen, E. (1998b, February 11). Human cloning ban runs into wall of science. *Los Angeles Times*, p. A1.

Cloning proponent "clearly unhinged" scientist says. (1998, January 8). *Globe & Mail*, p. A13.

Conduit, C. M. (1999). How the public understands genetics: Non-deterministic and non-discriminatory interpretations of the "blueprint" metaphor. *Public Understanding of Science*, 8, 169–180.

Confronting cloning. (1998, January 31). *Los Angeles Times*, p. B7.

Conrad, P. (1997). Public eyes and private genes: Historic frames, news constructions and social problems. *Social Problems*, *44,* 139–154.

Conrad, P. (1999). Use of expertise: Sources, quotes, and voice in the reporting of genetics in the news. *Public Understanding of Science*, *8,* 285–302.

Coren, M. (1998, January 15). The terrible consequences of playing God. *Toronto Sun*, p. 16.

Dionne, E. J., Jr. (1998, January 13). Hold off on cloning. *Washington Post*, p. A15.

Dow, S. (1998, January 17). Clone alone. *The Age*, p. 6.

Einsiedel, E. F. (1992). Framing science and technology in the Canadian press. *Public Understanding of Science*, 1, 89–101.

Elshtain, J. B. (1998). Bad Seed. *New Republic, 218,* p. 9.

Evenson, B. (1999, June 18). Scientists race to create first human clones. *National Post*, p. A1.

FDA says there'll be no human cloning in U.S. without its ok. (1998, January 20). *Dow Jones Online News*.

Fear of cloning. (1998, January 17). *The Economist*, p. 18.

Gerlach, N. (2004). *The genetic imaginary: DNA in the Canadian criminal justice system*. Toronto, Canada: University of Toronto Press.

Giddens, A. (1991). *Modernity and self-identity: Self and society in the late modern age*. Cambridge, UK: Polity Press.

Giddens, A. (2003). *Runaway world*. New York: Routledge.

Gomel, E. (2000). From Dr. Moreau to Dr. Mengele: The biological sublime. *Poetics Today*, *21,* 393–421.

Goodell, R. (1977). *The visible scientists*. Boston: Little, Brown.

Gough, M. (1998, January 9). Regulation is useless. *USA Today*, p. 13A.

Gugliotta, G. (1998, February 4). United against human cloning, Hill leaders differ on specifics. *Washington Post*, p. A04.

Gurdon, H. (1998, January 21). If abortion is right, why is cloning wrong? *The Daily Telegraph*, p. 22.

Hamilton, S. (2003). Traces of the future: Biotechnology, science fiction, and the media. *Science Fiction Studies*, *30,* 267–282.

Haynes, R. D. (1994). *From Faust to Strangelove: Representations of the scientist in Western literature*. Baltimore: Johns Hopkins Press.

Haynes, R. D. (1995). Frankenstein: The scientist we love to hate. *Public Understanding of Science*, *4,* 435–444.

Haynes, R. D. (2003). From alchemy to artificial intelligence: Stereotypes of the scientist in Western literature. *Public Understanding of Science, 12,* 243–253.

Healy, B. (1999, March 29). Ian Wilmut: Breaking the clone barrier. *Time*, p. 176.

Hello Dolly, goodbye Dr. Seed. (1998, January 14). *Edmonton Journal*, p. A8.

Hilton, B. (1998, January 14). 6 good reasons not to clone humans. *Vancouver Province*, p. A26.

Hopkins, P. D. (1998). Bad copies: How popular media represent cloning as an ethical problem. *Hastings Center Report, 2,* 6–13.

Hornig Priest, S. (1999). Popular beliefs, media, and biotechnology. In S. M. Freidman, S. Dunwoody, & C. L. Rogers (Eds.), *Communicating uncertainty: Media coverage of new and controversial science* (pp. 95–112). Mahwah, NJ: Erlbaum.

Hornig Priest, S. (2001). Cloning: A study in news production. *Public Understanding of Science, 10,* 59–69.
Hourigan, P. (1998, December 9). Home fires. *Hamilton Spectator*, p. D4.
Human cloning goes too far. (1998, January 14). *Montreal Gazette*, p. B2.
Jansen, R. (2001, March 13). Cloning offers only false hope for the infertile. *Sydney Morning Herald*, p. 13.
Kendall, P. (1998, January 18). Seeds of discontent. *Vancouver Province*, p. A43.
Kendall, P., & Kotulak, R. (1998, January 10). Dr. Seed's strange love of cloning. *Chicago Times*, p. H2.
Kirkey, S. (1999, October 15). Richard Seed: The face of human cloning. *Ottawa Citizen*, p. A1.
Krieger, L. (1998, January 10). Is he a mad scientist? *Halifax Daily News*, p. 12.
LaFollette, M. C. (1990). *Making science our own: Public images of science, 1910–1955*. Chicago: University of Chicago Press.
Lemonick, M. D. (1999, November 8). Hot genes for sale? A website offers eggs—but maybe just for browsing. *Time*, p. 56.
Lewenstein, B. V. (1995). Science and the media. In S. Jasanoff, G. E. Markle, J. C. Petersen, & T. Pinch (Eds.), *Handbook of science and technology studies* (pp. 343–360). London: Sage.
Life and style. (1998, January 15). *Los Angeles Times*, p. E-3.
Medical experts, ethicists debate human cloning. (1998, January 9). *Knight-Ridder Tribune Business News*, n.p.
Miele, F. (1999). The man who would be cloned. *Skeptic*, 7, 54–7.
Miller, D. (1995). Introducing the "gay gene": Media and scientific representations. *Public Understanding of Science, 4,* 269–294.
Mulkay, M. (1996). Frankenstein and the debate over embryo research. *Science, Technology & Human Values*, *21,* 157–176.
Nash, J. M. (1998, January 19). Cloning's Kevorkian. *Time*, p. 58.
Nelkin, D. (1995). *Selling science: How the press covers science and technology*. New York: W. H. Freeman.
Nelkin, D., & Lindee, M. S. (1995). *The DNA mystique: The gene as a cultural icon*. New York: W. H. Freeman.
Novas, C., & Rose, N. (2000). Genetic risk and the birth of the somatic individual. *Economy and Society, 29,* 485–513.
Oleson, T. (1998, January 8). Playing doctor or playing God? *Winnipeg Free Press*, p. A10.
Palmer, A. (1998, January 11). We should stop worrying and learn to love the clone. *Sunday Telegraph*, p. 31.
Physicist impossible to "stop science" group told. (1998, February 21). *Toronto Star*, p. A3.
Plans for human cloning trigger national uproar. (1998, January 8). *Los Angeles Times*, A18.
Pringle, V. (1998, January 16). New book explores possible scenarios of cloning. *Canada AM*.
Put controls on cloning. (1998, January 9). *USA Today*, p. 13A.
Radford, T. (1998, May 23). Double jeopardy. *The Guardian*, p. T20.
Radford, T. (2001, August 8). Deaf to the warning: Society and science are not read. *The Guardian*, n.p.
Rehmann-Sutter, C. (1996). Frankensteinian knowledge? *The Monist, 79,* 264–279.
Rhodes, T., & Macintyre, B. (1998, January 13). Europeans join U.S. bid to ban human cloning. *Times of London*, p. 12.
Rinaldo, S. (1998, January 8). Questions about a controversial doctor and his controversial plans to clone humans. *CTV National News*.
Robertson, L. (1998, January 7). A doctor is ready for human cloning. *CTV National News*.
Ruane, M. (1998, January 10). News features. *Irish Times*, p. 11.
Sapstead, D., & Highfield, R. (1998, January 8). Plea for cash to clone humans. *Daily Telegraph*, p. 01.
Science leading to human clones can help mankind, The. (1998, January 12). *Independent-London*, p. 12.
Scientist pushes ahead with plan to clone baby in next two years. (1998, January 13). *Winnipeg Free Press*, p. A10.
Skal, D. J. (1998). *Screams of reason: Mad science and modern culture*. New York: W. W. Norton.
Spears, T., & Laucius, J. (1999, October 21). Designer genes can be passed to future generations. *Ottawa Citizen*, p. A1.

Sternberg, S. (1998a, January 7). Entrepreneur plans to clone babies for childless couples. *USA Today*, p. 1A.
Sternberg, S. (1998b, January 8). Human cloning: Seed sees a world with disease free children. *USA Today*, p. 1A.
Sternberg, S. (1998c, February 26). Illusion or inspiration? *USA Today*, p. 6D.
Toumey, C. P. (1992). The moral character of mad scientists: A cultural critique of science. *Science, Technology & Human Values, 17,* 411–437.
Tudor, A. (1989). *Monsters and mad scientists: A cultural history of the horror movie*. Oxford, UK: Basil Blackwell.
Turney, J. (1998). *Frankenstein's footsteps: Science, genetics and popular culture*. New Haven, CT: Yale University Press.
Van Dijck, J. (1998). *Imagenation: Popular images of genetics*. New York: New York University Press.
Varadrajan, T., & Murray, I. (1998, January 8). Doctors call for human cloning ban. *Times of London*, p. 1.
Wadman, M. (1998, January 20). Cloning without human clones. *Wall Street Journal*, p. A18.
Weingart, P., Muhl, C., & Pansegrau, P. (2003). Of power maniacs and unethical geniuses: Science and scientists in fiction film. *Public Understanding of Science, 12,* 279–287.
Weingarten, P. (1998, January 25). Strange egg. *Washington Post*, p. F1.
Williams, P. (1998, February 13). Conceiving the future: Cloning opens moral puzzles of genetic hoarding. *Ottawa Citizen*, p. A15.
Wynne, B. (1995). Public understanding of science. In S. Jasanoff, G. E. Markle, J. C. Petersen, & T. Pinch (Eds.), *Handbook of science and technology studies* (pp. 361–389). London: Sage.