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Wilhelm Peekhaus¹

Abstract

Following in the footsteps of a variety of previous research that elaborates on the current state of affairs in academia, this article sets out the argument that neoliberalism and its corresponding iterations of science and technology and research funding policies in this country have implications for the types of knowledge that can be generated within and communicated without contemporary institutions of higher education. Using agricultural biotechnology as the lens through which to focus analysis, the article outlines a number of empirical examples that illustrate how the free flow of knowledge either critical of or not readily appropriated by capital is being impeded.

Keywords

science and technology, science communication, agricultural biotechnology, neoliberalism, higher education

Introduction

As interrogated by a growing corpus of scholarly literature, neoliberal policies over the previous few decades have imprinted an unambiguous stamp on the nature and functioning of tertiary education. Among other things, the effects of neoliberalism can be seen in the generation of conflicts of interest within the university, the skewing of research, expanding industry–academia linkages, and the indoctrination of a new generation of academic researchers motivated predominantly by private rather than public interest (Bok, 2003; Giroux, 2007; Krimsky, 1991, 2003; Levidow, 2002; Newfield, 2008; Olssen & Peters, 2005; Slaughter & Rhoades, 2004; Washburn, 2005). The practice of science within the university today is characterized increasingly by pressure on faculty to develop partnerships with corporate entities and engage in research agendas that promise to yield readily commercializable results; a development Elzinga terms an epistemic drift through which the utility of science is measured according to market criteria (as discussed in Etzkowitz, Webster, & Healey, 1998). Similarly, scientific knowledge, which has normally been considered an input necessary to expand the field, is, under mounting commercial pressure, being evaluated more and more as a research outcome that can drive industrial utility (Freeland Judson, 1994; Krimsky, 2003; Sigurdson, 1993). Etzkowitz and Webster (1998) speak of a “second academic revolution,” characterized by the drive to translate the research developed in institutions of higher education into products and new business ventures for the benefit of the private sector.¹

They assert that we can expect a growth in the amount of long-term collaboration between industry and universities, particularly with regard to fundamental, discovery-oriented research programs. Indeed, Kenney (1986) observed these trends already in the 1980s when he analyzed the relationships between universities and business, paying particular attention to the growth in start-up companies that were increasingly managed by businesspeople and active members of the professoriate.²

Of course, it might be objected that scientific ideas have long been translated into industrial applications as evidenced by the historical importance of the chemical and electrical industries to the Industrial Revolution.³ What does appear both quantitatively and qualitatively novel is the intensification of this process in terms of the reduced time frame between discovery and application, the strategic importance of the knowledge developed in academic institutions to industry, and the expanded push by governments to encourage universities into becoming incubators for economic growth and development through partnerships with business. This emerging macro context characterizes particularly the science of biotechnology and its attendant realm of technology. Indeed, Canadian government biotechnology policy, which has been informed by

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a national strategy since 1983, is typically articulated in the following terms:

Biotechnology is a powerful “enabling technology” with applications in many industrial sectors and holding much promise for the future. It has great potential to add to industrial efficiency, output and jobs, enhance the productivity and competitiveness of Canada’s important natural resource sectors, safeguard the environment and enhance our quality of life through improved pharmaceuticals, diagnostic medicine and food production. Many people see biotechnology as the next important “change maker” after the convergence of information, computer and telecommunications technologies, which have transformed our lives. All Canadians—producers and consumers across the country, including people in smaller communities and rural areas—will benefit from the new transformation (Industry Canada, 1998, p. 2).

In order to achieve the explicit claim made in such policy pronouncements about the ability of this new ‘enabling technology’ to fuel the motor for economic growth in this country, the government similarly has expressed the assertion that “[t]o fully capture the social and economic benefits of federal investments in basic research and information technology, there must be opportunities to translate new discoveries into biotechnology products and services through commercialization” (Government of Canada, 2004, p. 57). The confluence of Canadian biotechnology policy, and indeed Canadian science and technology policy more generally, with neoliberal educational governance positions biotechnology as a decidedly apropos case for study.

Building on the literature specific to the impacts of neoliberal policies on institutions of higher education, this article assumes as its starting point that most public universities, at least those in the three countries from which the empirical cases stem—Canada, the United Kingdom, and the United States—have been subject to market-driven transformations made manifest in such practices as expanding industry–academia partnerships and increasing commercialization of research; practices that respond to state policies that have reduced funding for colleges and universities while simultaneously intensifying the mandate to produce readily commodifiable knowledge. Placing an accent on Canada and concentrating on agricultural biotechnology, my general argument is that the increasing internalization and normalization of neoliberal policies within higher education has direct and detrimental implications for the generation and free flow of knowledge both within academia and between it and society. Put more explicitly, this article seeks to examine a number of cases that illustrate how the contemporary university’s increasing obedience to and subsumption by capitalist imperatives of accumulation inherent in neoliberalism are impinging upon the type of knowledge being generated within institutions of higher

education as well as the communication of that knowledge. In setting out my argument the first part of this article will establish the context for the subsequent empirical discussion by examining briefly some of the ways that neoliberal policies are being manifested within the academy in this country. With this background in place, the subsequent section of the article elaborates on a number of cases that illustrate the impact of these trends on the creation and dissemination of knowledge critical of the “enabling technology” agricultural biotechnology. The evidence presented here is based on documentary analysis and interviews I conducted with academics and others involved in issues around agricultural biotechnology.

Neoliberalism and the Contemporary University

While it is true that the effects and manifestations of neoliberal policies are historically and spatially contingent, there are a number of general trends common to processes of neoliberalization within developed countries. Neoliberalism⁴ traces its nascent stage from the late 1970s to mid-1980s, during which time a wide range of unambiguous market policies was introduced in both the developed and developing worlds. Most countries in the global North, led by Reagan in the United States and Thatcher in the United Kingdom, engaged in massive restructuring that included the promulgation of anti-union legislation and monetary and fiscal policies that seriously eroded real wages for the working class,⁵ the decimation of social spending budgets, and the introduction of corporate welfare programs designed to entice foreign capital inflows. Similar processes transpired in the global South, the difference being that the instrument used was debt crisis management, which greatly intensified during this period. This type of “management” was accomplished through policies of wage freezes, currency devaluations, and massive reductions in food subsidies and any other expenditure in public budgets that conflicted with capital’s own accumulation imperatives (De Angelis, 2007; Federici, 1992; Harvey, 2006).

The second phase, from the mid-1980s, represents a period of consolidation of neoliberal policies into what is commonly referred to as the “Washington consensus.”⁶ Viewed broadly, the Washington consensus enjoins states from active involvement in the social sector, asserts the primacy of the market by freeing it of constraints and yielding to it complete access to all spheres of social reproduction, and admonishes indito rely on themselves to ensure their socioeconomic reproduction rather than looking to the state for assistance (Chandhoke, 2002; Mooers, 2000; Panitch, 1994). The measures associated with this period of neoliberalism include strict fiscal discipline accompanied by stringent criteria for limiting public budgets⁷; a reorientation of public expenditure away from social spending and administration toward those areas that promise high economic growth; tax reform designed to broaden the tax base and reduce marginal tax rates; fiscal policy intended to promote

market determination of interest rates; trade liberalization to open export markets, eliminate quotas, and reduce tariffs; foreign direct investment policies that remove investment barriers and accord foreign investors opportunities equal to those enjoyed by domestic investors; privatization of state businesses and resources; deregulation, which is more accurately characterized as reregulation designed to promote business and markets; a strengthening of property rights, including intellectual property rights, as embodied most explicitly by the Trade-Related Aspects of Intellectual Property rights agreement; and, in the global South concerted efforts by the World Bank, the International Monetary Fund and their main Western supporters to impose Structural Adjustment Programs on heavily indebted nations that, among other things, transformed traditional land tenure systems to facilitate the privatization of vast expanses of once common lands (De Angelis, 2007; Harvey, 2006; Williamson, 1990).⁸

Institutions of higher learning have not been exempt from the effects of neoliberal restructuring of government agendas, as illustrated by a substantial body of critical literature that interrogates these various consequences (Bauder, 2006; Bok, 2003; Cooley, 1976; Federici & Caffentzis, 2007; Giroux, 2007; Krimsky, 2003; Levidow, 2002; Menzies, 2010; Newfield, 2008; Olssen & Peters, 2005; Roseman, 2010; Slaughter & Rhoades, 2004; Washburn, 2005). Rather than rehearse this literature, with which I am mostly in agreement, my intent here is to focus on a couple of important ways that neoliberal policies have been made manifest in this country (though certainly similar trends characterize the situation in respect of higher education in the United Kingdom and the United States). The first and perhaps most acute has been drastic government funding cuts. In Canada, reduced federal funding was exacerbated by Ottawa's decision in 1996 to amalgamate the previously separate postsecondary program financing along with transfer payments for healthcare and welfare into the Canada Health and Social Transfer. This new method of block transfer payments from the federal government to the provincial governments, who have constitutional jurisdiction over education, allowed the provinces and territories to determine how they would allocate these funds. Given the heavy emphasis at this time placed by Canadian governments at all levels and political persuasions on the neoliberal commitment to zero deficits and debt reduction, large portions of the Canada Health and Social Transfer went to debt retirement at the expense of many other social imperatives, including education.⁹

Concomitant to these policy developments there also emerged the now well-established "truth" among many governments, including Canadian, that economic growth and development depend on the ability of private enterprise to commercially apply and exploit the knowledge and innovation developed in educational institutions. These types of policy have been operationalized in a variety of ways in this country. For example, the Association of Universities and Colleges of Canada in 2002 signed a framework of agreed principles with the Government

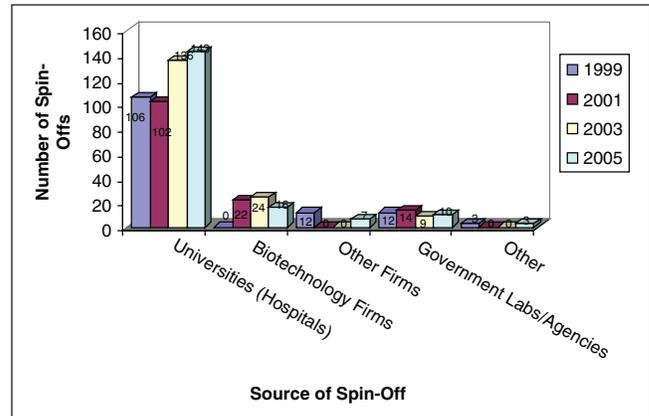


Figure 1. Number of biotechnology spin-offs by source of spin-off, 1999-2005

Source: Statistics Canada, *Biotechnology Use and Development Survey*—1999, 2001, 2003, and 2005

of Canada that commits universities to double the amount of research they conduct and to triple the amount of commercialization of this research (Association of Universities and Colleges of Canada, 2002). Evidence of this commitment can be seen in the well-staffed technology transfer offices found at universities throughout Canada, which continue to increase their staff complements in response to expanded commercialization activities on Canadian campuses (Bostrom, Bruce, & Flanigan, 2007). In part these developments have been facilitated by the opening up of most Canadian university boards and other top-level governance structures to members of the corporate community (Whiteley, Aguiar, & Marten, 2008). Specific to biotechnology, the effectiveness of these policies is reflected in the origins of the majority of companies in this industrial sector. From the beginning of this century most of the core Canadian biotechnology companies (defined as companies for which biotechnology is the principal activity and that conduct biotechnology R&D) have been spin-offs based on discoveries made in Canadian universities, research hospitals, and government laboratories (Industry Canada, 2005). Between 1997 and 2000 the National Research Council of Canada (NRC), a tax-funded federal research agency, had spun off more than 20 biotechnology companies from its five biotechnology laboratories¹⁰ (Industry Canada, 2000), although Canadian universities remain the single largest source of biotechnology firm spin-offs in this country: In 1999, 106 biotechnology companies were spun off from institutions of higher education and in 2001 and 2003 the numbers were 102 and 136, respectively (see Figure 1). In 2005, wording in the survey that tracks these developments was changed to include universities and hospitals together as sources of spin-off companies. Together these two types of institutions spun off 143 biotech businesses in 2005 (latest available data). One critical observer of this situation aptly sums up this trend, contending that we are witnessing

the appearance of a new academic type: the professor-entrepreneur who uses his academic affiliation as a launching pad for lucrative ventures . . . [with a] tendency to privatize revenues and socialize expenses (through the use of university administrative resources as well as 'free' student labour). (Warde, 2001, para. 11)

Such trends are set to be exacerbated by the latest iteration of federal science and technology policy—*Mobilizing science and technology to Canada's advantage*—according to which this country must engage more ardently in translating publicly funded research into commodifiable innovation. This new Harper Government strategy specifically states that universities should engage in basic research so that the private sector can avoid the time and costs associated with this type of research. The private sector is to have complete and unhindered access to the results of this research. Moreover, should it yield practical applications institutions of higher education are admonished to cooperate with business in commercialization. Business is set to win even further as this new policy also outlines the goal of reducing corporate taxation rates to the lowest levels among G-7 nations on new business investment (Government of Canada, 2007). That is, we are witnessing yet another instance of the socialization of costs and the private appropriation of any resulting rewards. In order to achieve these types of deliverables this new policy lays out specific plans to undermine the autonomy of Canada's major research granting institutions by inserting representatives from business into the various councils' governing bodies and soliciting private sector input about revamping policies and procedures for selecting fundable research proposals. This same document also makes a plea for producing more scientific researchers who are also trained in business skills—the underlying belief being that we only need to inculcate our scientific researchers with sufficient business acumen in order to increase overall levels of commercialization of college and university research (Government of Canada, 2007).¹¹ Given the overall tone of the policy document that outlines Canada's new science and technology policy, even the most casual reader is left with the distinct impression that fundable research equates to research that is readily commodified.

An inherent problem with this type of funding structure is that research projects that fail to promise readily commodifiable applications find it very difficult to obtain research grants. The result is a situation in which research questions that go beyond immediate, utilitarian concerns and instead respond to broader social issues run the risk of being marginalized and left unanswered. Precisely this concern has been raised by the Royal Society of Canada (2001):

In relation to food biotechnology, it is arguable that such a refocusing of the public research agenda makes it more difficult to find funds for research aimed at the critique or evaluation of GMO [genetically modified organism] technology or scientific researchers with the independence and objectivity to carry it out. (p. 217)

The general point that I want to make based on this brief account is that the discipline of funding cuts coupled with the federal government's emphasis on commodifiable research projects has helped normalize neoliberal values within academia in a way that has established the contemporary university as a site of capitalist appropriation. The corporatist ethos that informs current higher education policies and that has established a formidable beachhead within university governance structures threatens to exercise a censoring effect on the generation and communication of knowledge that is perceived to be antagonistic to capital. Put more explicitly, the internalization of neoliberal values and capitalist accumulation imperatives is exerting profound pressure on two of the most fundamental mandates of the university as institution—knowledge production and knowledge dissemination. Using agricultural biotechnology as the lens through which to focus our empirical investigation, we can now turn to an examination of several cases that illustrate the consequences for researchers, their research agendas, and the diffusion of their work when such research is perceived to challenge corporate interests.

Agricultural Biotechnology and the Academy

One well-known person within biotechnology circles who has experienced the repercussions for voicing critical concern in respect of this technoscience is interview informant Dr. E. Ann Clark, Associate Professor in the Department of Plant Agriculture at the University of Guelph. Over the past decade her financing has been curtailed significantly and she has been relocated from her original laboratory to make room for biotechnology researchers. Clark speaks of her dismay at the constant refrain heard from regulators and defenders of biotechnology about "science-based" decision making, when, according to her, there is very little science in the decision-making process. When technology (not science) leads, the driving motivation is commercial success, which results in an array of predictable and adverse potential outcomes. For example, there is, according to Clark, a near absence of interest in funding research that considers the possible adverse effects of genetic engineering. As she asserts, "after all, why would someone who benefits from the sale of the technology allow or encourage scientific risk assessment? They would not." Conversely, according to Clark, if science led technology then at least some of these potential risks would be identified and studied, giving regulators a more balanced information portfolio if they truly wanted to safeguard the public interest. This sentiment is echoed by Dr. Rene Van Acker, interview participant and Professor and Departmental Chair of the Department of Plant Agriculture at the University of Guelph, who maintains that rigorous, long-term research studies into the effects of genetic engineering are not being conducted due to a lack of sufficient funding. Fundamentally more problematic is that even if funded the technology developers are not bound to cooperate in such studies.

Precisely such concerns were articulated recently in the United States by 26 independent corn insect scientists, who penned the following joint statement to the United States Environmental Protection Agency (EPA) in February 2009, complaining that industry is impeding the efforts of researchers to study the effectiveness and environmental impact of genetically engineered crops:

Technology/stewardship agreements required for the purchase of genetically modified seed explicitly prohibit research. These agreements inhibit public scientists from pursuing their mandated role on behalf of the public good unless the research is approved by industry. As a result of restricted access, no truly independent research can be legally conducted on many critical questions regarding the technology, its performance, its management implications, IRM [insect resistance management], and its interactions with insect biology. Consequently, data flowing to an EPA Scientific Advisory Panel from the public sector is unduly limited. (U.S. EPA, 2009)

Dr. Elson Shields, a professor of entomology at Cornell University, laments the effects of the shift from public funding of agricultural research to the private sector: "People are afraid of being blacklisted. If your sole job is to work on corn insects and you need the latest corn varieties and the companies decide not to give it to you, you can't do your job" (Pollack, 2009, B3). These fears are all too real, as demonstrated by the caveat included in the joint statement to the EPA: "The names of the scientists have been withheld from the public docket because virtually all of us require cooperation from industry at some level to conduct our research" (U.S. EPA, 2009). In response to this letter, the American Seed Trade Association agreed in July 2009 to a set of principles for the use of seeds in academic research that ostensibly responds to the criticisms leveled by these researchers. However, it is still too early to assess whether these purely voluntary principles will improve the ability of academics to engage in independent testing of the claims being made by industry.

Following from the technological imperative that is fuelling biotechnology in this country, Clark believes that genetically engineered products have been released prematurely, with inadequate to negligible risk assessment research. This, according to her, is not to say that there is anything intrinsically harmful about genetic engineering. There is simply not sufficient evidence to say that, but then neither is there sufficient evidence to claim the reverse. *Absence of evidence is not evidence of absence*. As Clark contends, "the Canadian government is gambling that nothing will go wrong . . . This makes for a nation-wide experiment with one treatment and no control, and all the evidence on safety coming from those seeking regulatory approval for their products." Genetically engineered solutions are being promoted without due regard to the "precautionary principle."¹² Very little is known about risks, which should in itself urge caution. No consideration is given to

alternative means of achieving the same end through such things as weed management substitutes for glyphosate resistance. Consumers are being obliged to absorb the potential risks without the option of saying no. This, according to Clark, is achieved in Canada by denying mandatory labeling, and is done internationally by forcing nations to buy the products we want to sell them (e.g., doing an end-run around the restrictions of the Biosafety Protocol and using the World Trade Organization to override the European Union moratorium on the approval of genetically engineered food crops). Clark laments that, in effect, risk is being externalized involuntarily in a shameless and heedless process facilitated by our own government.

Clark hosts a confidential listserv (GE Alert¹³) that connects Canadian scientists concerned with biotechnology issues. The group is unfunded, wholly volunteer, and mobilizes primarily by writing papers, position papers, and popular press articles. Clark also helps the Council of Canadians, Greenpeace, and similar groups when asked for information, a conference talk, or other form of support. Yet people who help her with her talks or who review her papers will often not speak publicly. Even in GE Alert, most members are wholly anonymous in order to avoid retribution. Clark adds that there are only about 10 critical academics willing to be known publicly and most of them are retired, which leaves her and a very few people like her, such as Dr. Elisabeth Abergel at York University and Dr. Ralph Martin at the Nova Scotia Agricultural College, who are sufficiently knowledgeable about the issue and willing to speak publicly.

When Clark presented her first GE Alert paper at a press conference in Ottawa, the then Dean of the Ontario Agricultural College at the University of Guelph, Rob MacLaughlin, stated publicly in a *Toronto Star* interview that she had acted unethically in speaking out on something other than her area of expertise, which is pasture and grazing management. As a result, Clark was branded as being unethical in the national press for a few weeks. The Dean's comments, which were at variance with academic freedom, created a rather large uproar within the academy. On sabbatical at the time, Clark received a substantial outpouring of academic support for her right to say things as she saw them—even by those who disagreed with what she was saying. In the end, Dean MacLaughlin was sanctioned by Senate and Clark let the matter drop. MacLaughlin, however, did not. He subsequently tried to close down her confidential listserv, but again she was firmly within her rights as an academic so the Dean was forced to back down. However, her laboratory was expropriated while she was away on sabbatical, with her technician slated to move into a former seed storage room that had been heavily fumigated with toxic chemicals for 20 years. Clark strenuously objected and her lab assistant was moved into another, much smaller lab after her return from sabbatical. Clark also contends that when one is perceived to be a loose cannon, one is excluded from key committees, plum appointments, and research collaborations.

Aside from being verbally insulted by department chairs and faculty colleagues in public debates and in Internet postings,

her research funding has dried up almost entirely, though, as she points out, she is not alone in that regard. As we noted in the preceding section, Clark confirms the charge that today it is exceedingly difficult to secure access to research funding, including public funds, unless the proposed research has the potential to deliver results that are easily commercialized. She does not depend on corporations for funding since she would rather do without than be subject to their control. In this way she runs no risk of withdrawal of funding if she adopts a critical stance. Conversely, most of her colleagues are hostage to their funding sources. Clark goes on to bemoan that an academic who writes an article critical of some aspect of genetic engineering runs the very real risk of being subjected to personal attack, innuendo, and defamation—although those leading the charge seldom attempt to respond in any way to the critical substantive arguments. Or, as Clark tells us, “they dredge up some specious results from an industry-funded lobby group or a hack-for-hire to rebut the points.” Speaking from personal experience, David Schubert, a cell biologist at the Salk Institute in California, concurs with this general assessment, contending that “people who look into safety issues and pollution and contamination issues get seriously harassed” (as cited in Waltz, 2009, p. 28).

Precisely such practices were employed against Arpad Pusztai, Ignacio Chapela, and David Quist. In 1995, Dr. Pusztai, a recognized world’s leading expert on lectins (plant proteins) with 3 books and more than 270 papers to his credit, was awarded a 3-year £1.6 million research grant from the Scottish Office of the Government of the United Kingdom to investigate the safety of genetically engineered food. By late 1997, Pusztai and his team determined that rats fed on a diet of genetically engineered potatoes suffered a reduction in weight of their vital organs as well as a depressed immune system. In late June 1998, Pusztai, with the permission of the Director of the Rowett Institute where he conducted his research, was interviewed by journalists producing a British television program about genetically engineered food. Immediately following the broadcast of the program on August 10, 1998, Pusztai’s boss congratulated him for handling the questions well and the Rowett Institute put out a press release noting that “a range of carefully controlled studies underlie the basis of Dr. Pusztai’s concerns.” Yet within a few days, and purportedly on the heels of two telephone calls from the Prime Minister’s Office to the Rowett Institute, Pusztai was rewarded for his research efforts with a variety of attacks from the Royal Society, the Blair government, and even the director of the Rowett Research Institute.¹⁴

Efforts were made to impugn the validity of his work by attacking his methodology, despite the fact that the study had been approved in advance by the Biotechnology and Biological Sciences Research Council—the United Kingdom’s main funding body for the biological sciences. Pusztai was similarly accused of unprofessional conduct in speaking about his findings on the record before his work had been peer reviewed. This claim was easily defeated when his research subsequently passed an expanded peer-review process and

was published—though not before the Royal Society reviewed an incomplete research report Pusztai and his colleague Stanley Ewen had written. On the basis of this unpublished work, the Royal Society carried out a vitriolic and biased campaign against Pusztai, even going so far as to threaten the position of *The Lancet* editor should he publish the full and complete paper after it passed peer-review. That is, the Royal Society condemned Pusztai and his research on the basis of incomplete information and ahead of publication of the full paper in *The Lancet* (Ewen & Pusztai, 1999). According to reporters who broke the story about the bullying tactics of the Royal Society, an influential group within this body established a “rebuttal unit” to push a pro-biotechnology line and respond to and challenge opposing scientists and environmental groups. Part of the agenda of this group within the Royal Society apparently was to develop a positive public and scientific discourse around biotechnology. Although denied by leaders of the Royal Society, a leaked British government memo outlined how its Office of Science and Technology was compiling a list of eminent scientists willing to respond to critics in a manner supportive of the government’s underlying and unequivocal pro-biotech message (Flynn & Gillard, 1999). Incidentally, Health Canada continues to respond to questions about the Pusztai study by propagating the myths expounded by the Royal Society: “Since that time, several groups, including the British Royal Society, have reviewed the results of those studies and concluded that the evidence does not support claims that genetically modified potatoes used in those studies had adverse health effects on rats” (Health Canada, 2006, para. 10).

Even more directly, Pusztai’s research project was almost immediately halted, his team was disbanded, all his data were confiscated, he eventually would be forced to take retirement, and he was enjoined legally from discussing the case publicly for 7 months. As Dr. Sue Mayer from GeneWatch UK laments, “[i]t is quite extraordinary the lengths the biotech industry and the scientific establishment will go to discredit any critical science” (as cited in Rowell, 2002, para. 32). Nonetheless, in light of his work the British Medical Association issued a public call for a moratorium on planting genetically engineered crops. It has also come out in support of labeling for genetically engineered products and made a plea to researchers to stop employing antibiotic-resistant marker genes. More generally, the British population overwhelmingly rejected genetically engineered food to such an extent that the major grocery chains moved swiftly to remove them from their products and shelves. Pusztai would be further vindicated in 2005 when a secret Monsanto document leaked to the press demonstrated that the company’s own research showed reduced kidney weights and other variations in blood composition among rats fed its genetically engineered corn MON863¹⁵ (Lean, 2005).

University of California at Berkeley Professors David Quist (Quist was Chapela’s graduate student at the time) and Ignacio Chapela were also the victims of concerted attacks on their

credibility after publishing an article in *Nature* outlining the results of their study that demonstrated genetically engineered corn had cross-pollinated with and contaminated indigenous varieties in Oaxaca, Mexico. On the basis of their findings Quist and Chapela also suggested that the viral promoter used to introduce the genetically engineered trait into the maize genome resulted in insertion at multiple points because the transgenic constructs might fragment and move around the genome (the effectiveness, precision, and safety of many of the processes employed to introduce genetic constructs into plant genomes increasingly are being called into question by a number of scientists¹⁶) and that the transgenes might be passed along to progeny (Quist & Chapela, 2001). These findings portend very serious environmental and cultural consequences for not only is Mexico home to the largest genetic diversity of maize in the world but this crop is firmly embedded in the culture of its people. This contamination of indigenous landraces was particularly surprising because Mexico had instituted a moratorium on the cultivation of genetically engineered maize in 1998 and the genetically engineered crops planted prior to this date were grown 60 kilometers away from the contaminated area.

Soon after their article was published, multiple posts were made by Mary Murphy and Andura Smetacek to a listserv operated by AgBioWorld, in which the study's authors were accused of conflicts of interest and of being "fear-mongering activists" seeking to attack "biotechnology, free trade, intellectual property rights and other politically motivated agenda items" (Matthews, 2002, p. 30). AgBioWorld, run by ardent biotechnology proponent Dr. C. S. Prakesh of Tuskegee University in Alabama, has been associated with the high-powered Washington, D.C.—based public relations firm Bivings Group, which has worked for Monsanto. Murphy and Smetacek attacked the study and called on scientists to inundate the journal with calls to retract the article. As it turns out, Jonathan Matthews, an anti-GE campaigner and *Ecologist* columnist, was able to trace the comments posted by Smetacek to a Monsanto computer and those by Murphy to Bivings.¹⁷ As a result he contends that "there's no ethics at all in what's going on here. It shows an organization that is determined to push its products into countries around the world and it's determined to destroy the reputation of anybody who stands in their way" (as interviewed in Robin, 2008).

Responding to four critical letters sent on the basis of the comments being generated on the AgBioWorld listserv, *Nature* Editor Philip Campbell requested a riposte from Quist and Chapela as well as additional data to support the claims advanced in their article. Quist and Chapela complied but in the end Campbell, on the basis of a recommendation from one of the three reviewers of the new data, made the decision to disavow the article. Though not an outright retraction, the opinion of the editor, as outlined in an editorial footnote to an article critical of the original paper, is that the latter should never have been published in the first place:

In our 29 November issue, we published the paper "Transgenic DNA introgressed into traditional maize landraces in Oaxaca, Mexico" by David Quist and Ignacio Chapela. Subsequently, we received several criticisms of the paper, to which we obtained responses from the authors and consulted referees over the exchanges. In the meantime, the authors agreed to obtain further data, on a timetable agreed with us, that might prove beyond reasonable doubt that transgenes have indeed become integrated into the maize genome. The authors have now obtained some additional data, but there is disagreement between them and a referee as to whether these results significantly bolster their argument. In light of these discussions and the diverse advice received, *Nature* has concluded that the evidence available is not sufficient to justify the publication of the original paper. As the authors nevertheless wish to stand by the available evidence for their conclusions, we feel it best simply to make these circumstances clear, to publish the criticisms, the authors' response and new data, and to allow our readers to judge the science for themselves (editorial footnote in Metz & Fütterer, 2002, p. 601).

I contacted Philip Campbell at *Nature* to inquire about this affair and received the following response: "It is our usual policy not to discuss the rationale behind decisions as to what to publish. If you wish to send me your questions by e-mail, I am happy to see them and consider whether we can help." I subsequently submitted questions based on the evidence presented here but have yet to receive a response.

Despite the vociferous critique, at least part of the findings presented by Quist and Chapela in their article would soon be corroborated by additional, independent studies conducted by the Mexican environment ministry. In fact, as reported in *Nature*, Mexican officials confirmed that transgenic corn had been detected in 15 of 22 areas tested in Oaxaca and Puebla (Dalton, 2001). Moreover, the levels of transgenic contamination found by the Mexican government studies were even higher than those found by Quist and Chapela: in 11 areas contamination was between 3% and 13%, between 20% and 26% in 4 others, and as high as 37% in food stores maintained by the government (Platoni, 2002). In May 2002, Jorge Soberon, Executive Secretary of Mexico's National Commission on Biodiversity, reported at a conference in the Hague that tests demonstrated the contamination of wild crops by genetically engineered varieties was in fact far worse than first reported (Meek, 2002). Thus while their suggestion that the introgression of transgenes into landrace varieties might be passed along generationally to progeny plants might warrant critical scrutiny and divergence of opinion, their main finding about the contamination of traditional maize varieties through genetic drift is beyond dispute.

The smear tactics employed against Chapela reverberated even more deeply because of their chilling effect on further

research into the spread of genetically engineered corn in Mexico. Chapela possesses five different studies conducted by Mexican researchers that support his own findings, one by the National Ecology Institute and another by the agriculture ministry's secretariat. Yet no academic journal has been willing to publish this research. Chapela contends that "the Mexican government does not want those papers published and, of course, neither does the biotech industry, so they will not appear anywhere." Chapela goes on to add that "they have made an example of me. Other scientists see this and decide that maybe they should go back to studying the bristles on the back of a bug" (as cited in Ross, 2004, para. 21). One of Chapela's colleagues, Dr. Miguel Altieri, accuses *Nature* of bowing to economic pressure:

Nature depends on its funding from big corporations. Look at the last page of the journal and see who funds the ads for jobs. Eighty percent are technology corporations, paying anywhere from \$2,000 to \$10,000 per ad. I think that *Nature* is not a reputable scientific journal anymore because it has a price. (as cited in Platoni, 2002, para. 8)

A joint statement issued in February 2002 by the Food First Institute and signed by 144 farmers' and nonprofit organizations accused industry of engaging in damage control tactics meant to intimidate Quist and Chapela "as a warning to any other academics who break ranks over GM research" and to "keep doubts circulating as to whether or not Mesoamerica is contaminated." These groups also made the point that "regardless of the methodologies involved, no serious scientist can really dispute the contamination" (as cited in Platoni, 2002, para. 10).

In fact, new findings from a study conducted by researchers at the National Autonomous University of Mexico in 2008 have established the persistence of genetically engineered maize crops in traditional landrace varieties in Mexico (Piñeyro-Nelson et al., 2009; Snow, 2009). As Dr. Norman Ellstrand, a plant geneticist at the University of California at Riverside, suggests, "the importance of the [2008] study is not in the impact of the transgenes themselves but in the fact that their spread has occurred so easily in a country where the planting of transgenic maize has not occurred for several years" (as cited in Dalton, 2008, p. 149). The researchers documenting the latest presence of genetically engineered maize varieties in Mexican landrace populations also elaborate methodological concerns about the studies conducted in 2003 and 2004 that failed to detect significant levels of transgenes in traditional maize varieties, studies that industry trumpeted in its efforts to excoriate Quist and Chapela (Piñeyro-Nelson et al., 2009). These latest researchers thus conclude that "the failure to detect transgenes in individual studies should not be taken as evidence of their absence based on the sampling and analytical methods used up to now" (Piñeyro-Nelson et al., 2009, p. 760). Yet in

another telling instance of the impact of industry influence on the scholarly research process, the lead researcher of the team in Mexico, Dr. Elena Álvarez-Buylla, has made it clear that while she suspects the conclusion made by Quist and Chapela that genetically engineered traits can be passed on to successive generations of contaminated landrace varieties is indeed correct, she will not pursue that line of investigation further because of the politically charged nature of such lines of inquiry (as discussed in Dalton, 2008).

Another prominent Canadian battle over academic freedom in respect of research critical of biotechnology was waged in recent years at the University of Manitoba, which in 2000 concluded a \$7 million deal with Monsanto to lease the company a building on campus that would be transformed into a Crop Technology Centre. The 10-year lease was negotiated at the request of Agriculture and Agri-Food Canada and was concluded without debate or input from members of the university community. More dramatically, the university, which clearly has strong ties with Monsanto, stalled the release of the documentary film *Seeds of Change* for over 3 years. This film, which is part of doctoral work conducted by Ian Mauro (another interview respondent) and his dissertation supervisor, Dr. Stéphane McLachlan, examines the impact of and controversies surrounding the introduction of genetically engineered seeds on the Canadian Prairies.

Mauro and McLachlan received funding from both SSHRC and the Agriculture Canada Manitoba Rural Adaptation Council to complete the film. In both funding proposals, Mauro and McLachlan stated explicitly that they planned to use any grants from these agencies to create farmer-focused documentaries designed to communicate the issues they were exploring around genetically engineered agriculture. As Mauro makes clear, his research adopts an interdisciplinary approach rooted in the experiential knowledge of farmers that strives to elucidate the ecological, cultural, and socioeconomic impacts of genetically engineered crops as experienced from farmers' perspectives. Because Mauro is committed to participant action research, he and McLachlan worked actively with farmers to construct the film in a manner that would be relevant to them and that would help facilitate community agency and community capacity building. The project was thus developed to research and learn about what was happening in respect of genetic engineering on the Canadian Prairies in a manner that not only built these communities into the project but also immediately contributed back to them as a way to create goodwill. Mauro and McLachlan started the project in 2002.

Immediately on commencing the project, McLachlan, in his capacity as dissertation supervisor, began engaging with the university administration in order to ascertain the procedures surrounding video production, including a discussion of intellectual property rights with respect to video and how they might differ from other academic work products. According to Mauro, the University of Manitoba was initially equivocal,

unable to offer any definitive pronouncements since the production of a film or a research video was a first at the university. Despite some of these open questions Mauro began collecting his data and by the end of summer 2002 he had completed the majority of his interviews, including with such prominent personalities as Percy Schmeiser, Vandana Shiva, and David Suzuki. Final production and scoring of the film was nearing completion toward early January 2003. During the autumn of 2002, discussions with the university around intellectual property continued, although things began to become more complicated. A private company had been located that was prepared to invest \$35,000 to finance the distribution of the film. According to Mauro the success in attracting private investment generated excitement for the project among university administrators, particularly given their emphasis on attracting corporate funding to the university. This, coupled with the currency of the film at a time when opposition to the introduction of Monsanto's genetically engineered wheat into Canadian fields was growing, resulted in a very supportive stance toward the research from the University of Manitoba, at least initially. By late 2002, the Director of Research Services at the University of Manitoba entered into dialogue with the distribution company executive and eventually a distribution deal was signed between the university and this company. As Mauro explains, the university could not believe that a project about biotechnology and farmers was attracting this kind of money and attention.

As part of his action research methodology, Mauro returned to the farmers he had interviewed to screen the film with them in their homes to guarantee that all respondents were satisfied with the way the film had been constructed. That is, Mauro took pains to ensure that the film was participatory, that it was created with the farmers, and that the farmers provided informed consent for both interviews and the final film itself. As the project neared completion, Mauro and McLachlan screened the film for the university administration, including the university lawyer and the Director of Research Services. As Mauro recounts, it was at that moment that the discourse between him and McLachlan, as researchers, and the University of Manitoba changed. Although the film deals with the benefits of biotechnology, it also candidly treats the attendant risks of this technoscience. The farmers that Mauro interviewed voiced significant concerns about Roundup Ready¹⁸ wheat. They indicated substantial apprehension about the trajectory of biotechnology as a project being executed on the Canadian Prairies. Moreover, many interviewees expressed their discontent and, at some level, their explicit dissatisfaction with the aggressive tactics Monsanto was employing around Roundup Ready canola, as well as the company's enforcement of its intellectual property rights and corresponding treatment of Percy Schmeiser.¹⁹

The university administrators saw the film and, according to Mauro, they were afraid of it and the anticorporate message that came out of it; a message that emanated from the research

participants and not from Mauro and McLachlan. At this point, university administrators articulated their concern about being sued by the biotechnology industry and thus began erecting roadblocks to stymie the release of the film. Mauro and McLachlan pointed out that the film is a research product and that because the tenets of academic freedom dictate that research is supposed to be unhindered, the film should be released. The University of Manitoba refused. What ensued was a series of prolonged negotiations with university administrators and lawyers. Realizing that the university lawyer was not negotiating on their behalf, Mauro and McLachlan demanded that the university retain a separate lawyer to represent their interests, which it did. Over the course of the next year and a half, Mauro and McLachlan, with the aid of their lawyer, tried to secure the release of the film. In the face of the university's fears about liability and an apparent incapacity to insure itself against a lawsuit, Mauro's and McLachlan's lawyer, who is an entertainment lawyer, recommended that a way around the intransigence of the university would be to purchase errors and omissions (E&O) insurance—something that is common practice in commercial documentary filmmaking. Mauro and McLachlan thus found themselves compelled by the university to steer the project along the route of intellectual property rights and information control, whereby every person in the film had to sign off on an additional University of Manitoba release form. Mauro therefore went back to the film participants and asked each interviewee to sign a specific waiver that included the film's title, the amount of minutes that person appeared in the film, and the details about the potential liabilities surrounding the film. With the exception of Vandana Shiva, who refused to sign off on it because she believes neither in intellectual property rights nor in the need to sign a piece of paper in the Western colonial tradition that exchanges intellectual property rights,²⁰ all participants signed the insurance waiver.

Having obtained all the waivers and completed the necessary application, Mauro and McLachlan submitted the package to an E&O insurance company. The company offered to provide insurance, explaining that although not a high risk, there did nonetheless exist the potential for lawsuits. Based on the calculated risk, the insurance company committed to underwriting a policy for a premium of a little more than \$3000 per year over 3 years. In the case of a lawsuit, the policy outlined a \$10,000 rider, which would increase to \$50,000 if Monsanto, a company known for its active use of litigation, initiated the lawsuit. While this may appear to be a large sum of money, it should be kept in mind that the film cost about \$120,000 in total to make. For about \$10,000 the film could be insured but the negotiations with the university remained deadlocked. Now however, the university, continuing to articulate its fear of being sued, developed the position, after almost 2 years of negotiations, that it was no longer interested in purchasing E&O insurance. As Mauro explains, this period was an extremely

stressful time for both him as a graduate student and his supervisor, McLachlan, who did not have tenure at this point in his career. Both felt very vulnerable. Added to all of this was a claim made by some within the university administration that Mauro and McLachlan had not properly adhered to the guidelines for ethics approval. This was a completely spurious claim that was readily refuted, but it does indicate the degree of harassment to which these researchers were subjected. Refusing insurance, the University of Manitoba then proceeded to claim that the film was not research and that it had been created independently of the university. As a result, so argued the university, it could not support the film. Given this new university position, Mauro and McLachlan found themselves entering into negotiations with the Vice President of Research for the university about whether or not their film constituted research.

As might be imagined, this changed the whole dynamic of negotiations, with Mauro and McLachlan having to justify what they were doing. First the university was completely supportive, then obstructionist, and then suddenly revisionist, completely rewriting the history of the film's development, alleging it was no longer a university project. The university attempted to justify this latest claim through reference to the private investor, arguing that such outside involvement meant the project was independent. Yet as outlined above, it was actually the University of Manitoba that signed the deal with the distribution company, a fact clearly evident from the documentation surrounding the distribution agreement and associated release forms that funneled the bundle of intellectual property rights to the University. At the same time, the Director of Research Services, with whom Mauro and McLachlan had been working, and the only person from the university who understood the history of the project, disappeared. Mauro and McLachlan were thus forced to negotiate with various vice presidents of the university, most of whom had very little knowledge about either the project or the state of negotiations up to that point. In fact, the main points made explicit to these people were that the research project is accompanied by a potentially huge liability and that the film is actually not even university research.

The University of Manitoba subsequently proceeded to reverse its position about the film not being a university project and invoked an outdated and little-used clause in the university's collective agreement with faculty that provides the university with a 50% ownership stake in teaching videos. As Mauro argues, this film is a research project, a creative piece; it is the equivalent of a book in video form. In no way is it a teaching video. Yet the university claimed half ownership and refused to release it unless Mauro and McLachlan would do exactly as it stipulated. There were three main demands the university articulated: the first, and most egregious, according to Mauro, was that he and McLachlan would personally have to indemnify the University of Manitoba against any lawsuits. Second, Mauro and McLachlan would not be permitted to use their university affiliations when disseminating the film. Third,

they would only be allowed to distribute and use the film for educational purposes. The University of Manitoba did not want the film screened in movie theaters. As might be expected, both Mauro and McLachlan were extremely upset when they heard the university's terms for release of the film. For both, the situation smacked of extortion.

At this point, in early 2005, Mauro and McLachlan approached the Canadian Association of University Teachers (CAUT). Jim Turk, the Executive Director of the CAUT, after having examined all of the material surrounding the film, pointed out that Mauro and McLachlan were engaged in one of the biggest fights over intellectual freedom in the country at the time. Turk encouraged them to build a campaign against the University of Manitoba, which they began in the spring of 2005. As Turk points out, by hindering release of this very topical film at a time when there was significant public engagement around issues of agricultural biotechnology in Canada (e.g., Monsanto's lawsuit against Percy Schmeiser and the resistance against the introduction of Monsanto's genetically engineered wheat), the actions of the university effectively suppressed research for what the CAUT considers to have been political reasons.²¹ In complete parallel to all of this, Mauro, while browsing the Monsanto Canada website to see if it contained any information about one of the recent decisions in the Organic Agriculture Protection Fund case,²² read about a new corporate partnership between the University of Manitoba and Monsanto, through which Monsanto relocated its Canadian corporate headquarters to the University of Manitoba Smart Park. Moreover, the university contact who signed the announcement on the Monsanto webpage was the person once in charge of research services at the University of Manitoba; the same person Mauro and McLachlan had been dealing with from the beginning and who had disappeared halfway through the negotiations. It turns out that this person had been promoted to being an Associate Vice President at the university and President of Smart Park. It was during his tenure in these positions that he then landed a position with Monsanto. According to Mauro he played both sides of the fence, actively suppressing what Mauro and McLachlan were doing, and as soon as the time became ripe he courted Monsanto and landed its Canadian corporate headquarters at the University of Manitoba. It was at this point that Mauro realized he and McLachlan had been sold out by their university in a violation of every tenet of academic freedom that also betrayed the prairie history on which the university had been built.

Consequently, Mauro and McLachlan made the decision to take their fight public and see it through right to the end. Mauro went back out into the farm community to communicate to its members what was happening, and, according to him, all of these farmers said "let's do this, let's get this thing out." A number of them actually helped to develop the campaign. With the assistance of the CAUT, Mauro and McLachlan launched their "free the film" campaign. The issue also attracted media coverage and commentary that portrayed the

fight in “David versus Goliath” terms, that is, powerless graduate student versus the giant university apparatus. With the help of the CAUT, a number of student organizations, and a variety of farmer organizations, the film was toured across Canada over the following year. In the interim, Mauro has distributed thousands of DVD copies of the film all over the world, and he makes it available for free download over the Internet. As of April 2010, the associated website (<http://www.seedsofchange.org/>) has received more than 500,000 unique web hits and the video had been downloaded thousands of times from the site.

As a result of its efforts to suppress the film, the University of Manitoba was nominated for a Captain Hook award in 2006.²³ Although the University of Manitoba has denied it, little imagination is required to surmise just what degree the critical nature of the film, particularly its treatment of Monsanto, played in the decision taken by the university administration to try and suppress it through actions that blatantly trounced the tenets of academic freedom, including, most importantly, the principle of unhindered dissemination of research results. I did speak with the Director of Public Affairs for the University of Manitoba, John Danakas. Although he maintains that the university had and continues to support the work of Dr. McLachlan and that this issue was always one of confusion over intellectual property rights, during the conversation it became clear that he was not sufficiently knowledgeable of the events as they unfolded to offer a complete explanation. I also contacted Dr. Digvir Jayas, Vice President for Research at the University of Manitoba, as well as the office of the university lawyer. Jayas subsequently provided a written transcript of responses to questions about the controversy over the film offered by then Vice President for Research Joanne Keselman to Senate at a meeting from October 18, 2005. According to Keselman,

this “case” is not about academic freedom; it is about the conditions under which the University will enter into business arrangements with outside private companies that are requesting access to research materials in which the University has an interest, and the proper use of research materials which the University has a fundamental obligation to ensure.

Keselman asserts two main issues to be at stake: the involvement of the third party distributor and the informed consent process. The former is rather baffling because, as Mauro maintains, it was the university that actually executed the contract with the distribution company. The second concern revolved around protecting research subjects who, according to Keselman, were not properly informed about the full range of uses that would be made of their videotaped interviews. As we saw above, Mauro disputes this claim. More important, even if we accept Keselman’s claim that the scope of the original informed consent forms did not include film production purposes, the fact that a second set of release forms were solicited and obtained from every person who appears in the film long

before this Senate meeting took place renders problematic her account of events.

Conclusion

As was the factory, so now is the university. Where once the factory was a paradigmatic site of struggle between workers and capitalists, so now the university is a key space of conflict, where the ownership of knowledge, the reproduction of the labor force, and the creation of social and cultural stratifications are all at stake. This is to say the university is not just another institution subject to sovereign and governmental controls, but a crucial site in which wider social struggles are won and lost (Federici & Caffentzis, 2007, p. 63).

As this article has endeavored to illustrate, neoliberal policies continue to metamorphose institutions of higher education into sites of production as part of an underlying innovation infrastructure that is imperative to the expansion of contemporary capitalist social relations throughout society. The changing environment of what has been referred to provocatively as the edu-factory, characterized by reduced state support for institutions of higher education, steadily tightening industry and academia linkages, and a growing normalization and internalization of neoliberal market values within the academy, has direct implications not only for research topics and their direction, but also for the dissemination of knowledge. Given the heightened emphasis on commercializable research agendas within both universities and funding agencies, the general intellect developed within the academy is being appropriated with alarming frequency by capital. Knowledge that fails to fit the corporate paradigm increasingly runs the risk of going unfunded while the push to patent and spin off firms has evolved into a major preoccupation across university campuses in this country. These transformations of the academic landscape ally with broader federal science and technology policies that seek to harness the economic potential of select areas of science and technological development being heralded as the cutting-edge drivers of this country’s future growth and prosperity. As neoliberal government agendas reduce funding for educational institutions yet simultaneously emphasize the role research and technological development will play in leading future economic growth, should it really come as any surprise that commercial imperatives progressively infiltrate university campuses?

Specific to the area of science chosen as the empirical focus for this article, we have seen that researchers run a risk of being marginalized professionally and academically if they voice critique of biotechnology. In keeping with the subject matter of the evidence marshaled above, we might argue that the genome of the contemporary university is being reengineered in a manner that affects not only on the way we can express ourselves within and without this institution, but perhaps more fundamentally on what the university does and in whose

interests. Given this general context, should we be astounded that the free flow of critical forms of knowledge inconducive to the edu-factory is being impeded both in this country and abroad? Probably not. But as Federici and Caffentzis also make clear in respect of the edu-factory metaphor, the university, not yet completely assimilated by capital, remains a critical site of social struggle. We need to problematize the imposition of capitalist social relations in the university setting without invoking some sense of nostalgia for a romanticized past. By recognizing that the commodification of higher education is a process made possible by social and conflictual power relations, we open up the possibility of glimpsing lines of flight and terrains of resistance. While certainly increasingly difficult, as demonstrated by the travails experienced by the various academics examined above, resistance remains possible. Indeed the very existence of these researchers attests that within the academy we are witnessing lines of fight that serve to question dominant knowledge paradigms by producing and communicating oppositional knowledge antagonistic to capital's appropriation imperatives. If we want to stave off the wholesale co-optation of institutions of higher education that seeks to reduce them to instrumental adjuncts of capital, we need to support and champion the dissidents within who are brave enough to question and challenge this emerging *status quo* in ways that blaze the trail for others to follow in rejecting the normalization of neoliberal norms and values and opening up discourses and practices that restore the university as an institution that serves all of society and not just business.

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Notes

1. The first academic revolution involved a change in emphasis among universities from being bastions of cultural preservation to becoming institutions concerned with expanding the frontiers of knowledge (Etzkowitz & Webster, 1998).
2. Yoxen's (1981) review of the history of molecular biology indicates that there was a substantial amount of reluctance among scientists to conceive of their work as one of the structural components driving industrialization and economic growth, but that once this transpired, structural change within the institutions of science was quick to follow.
3. Hindmarsh and Lawrence (2004) point to an even earlier historical period, discussing Francis Bacon's ideas of science as technology.
4. The conceptual roots of neoliberalism date from the late 1930s when it emerged as a relatively obscure school of thought

opposed to communism, socialism, and all forms of government intervention in the economy that went beyond providing protection for private property and market institutions. By the 1940s, a number of influential scholars, including Friedrich von Hayek, Ludwig von Mises, and Milton Friedman, began engaging actively with this theory, although it remained beyond conventional economics until the financial crises of the 1970s discredited then mainstream Keynesianism and demand-side economics. A number of authors provide deeper and very helpful discussions of neoliberalism (De Angelis, 2007; Harvey, 2003).

5. For example, Paul Volcker, Chairman of the United States Federal Reserve Bank, shifted American monetary policy in October 1979 away from the Keynesian bargain that made full employment a fiscal policy objective toward the goal of reducing inflation, regardless of the consequences for employment levels or for the economies of countries that were sensitive to American interest rates and dependent on American economic conditions (Harvey, 2006).
6. Wallerstein (2004) refers to neoliberalism as the theory of the end of the Fordist phase of capitalist development and the Washington consensus as policy. The World Economic Forum at Davos expounded the theory and the International Monetary Fund, the World Bank, and the World Trade Organization operationalized the Washington consensus (Wallerstein, 2004). The collection edited by Fine, Lapavistas, and Pincus (2001) offers a good discussion of the ideological offensive implicated in the emergence of the Washington Consensus.
7. "Excessive" public spending and wage demands were particularly favorite bogeymen invoked by neoliberals (especially Reagan and Thatcher, respectively) as putative causes of high unemployment and inflation.
8. Peck and Tickell (2002) differentiate between what they term the *roll-back neoliberalism* of the 1980s that engaged in deregulation and dismantling of the Keynesian welfare state and *roll-out neoliberalism*, the more current phase (at least until the global recession brought on by the near collapse of the banking sector in most OECD countries) that has emerged in the form of conservative social policies in the areas of crime, policing, welfare reform, and urban surveillance as attempts to discipline those subjects who were dispossessed by the previous roll-back phase of neoliberalism.
9. In fiscal year 2004–2005, the Canada Health and Social Transfer was divided into the Canada Health Transfer and the Canada Social Transfer in order to establish increased transparency and greater accountability for federal health care funding.
10. This group includes the NRC Plant Biotechnology Institute in Saskatoon, the NRC Institute for Marine Biosciences in Halifax, the NRC Institute for Biological Sciences in Ottawa (biopharmaceutical research), the NRC Biotechnology Research Institute in Montreal (biopharmaceutical research), and the NRC Institute for Biodiagnostics in Winnipeg.
11. The Labour Government in the United Kingdom is engaging in similar policies, committing £250 million to the creation of

- 44 centers to train 2,000 PhD students over the next 5 years. These students will spend up to 75% of their time training with industrial partners (Mulland, 2008).
12. As set out in paragraph 2(1)(a) of the *Canadian Environmental Protection Act* (1999, c. 33) the precautionary principle means that “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” This is a widely accepted definition that was endorsed at the Earth Summit in Rio de Janeiro in 1992 and is reflected in the Rio Declaration.
 13. GE Alert is an independent group of scientists, academics, and agricultural professionals committed to informing Canadians about the implications of agricultural genetic engineering. Members have no ties to the life science industry and are therefore free of potential corporate conflicts of interest.
 14. Ferrara and Dorsey (2001) offer a deeper discussion of this incident.
 15. MON863 is a maize variety genetically engineered to produce a toxin that is lethal to corn root worm.
 16. See, for example, Ferrara and Dorsey (2001), Ho (1999), Ho, Ryan, and Cummins (1999), Lotter (2009), The Royal Society of Canada (2001), Wilson, Latham, and Steinbrecher (2006), Zolla, Rinalducci, Antonioli, and Righetti (2008), and Wheale and McNally (1998).
 17. See also the articles by George Monbiot (2002a, 2002b) published in *The Guardian* that illuminate in greater detail the role of Bivings Group in creating these fake persona.
 18. Roundup Ready is the trade name Monsanto uses to market its line of seeds genetically engineered to withstand applications of glyphosate, the active ingredient in its Roundup herbicide formulations.
 19. Percy Schmeiser was sued successfully by Monsanto for violation of its intellectual property rights. According to the company, Schmeiser illegally planted its genetically engineered canola. Schmeiser claims that the genetically engineered volunteers in his fields were the result of contamination. Schmeiser’s case, which went to the Supreme Court of Canada, is probably the most well-known and publicized example of the treatment a number of farmers in North America have suffered at the hands of Monsanto. For details of Schmeiser’s experience, see his website at the following URL: <http://www.percyschmeiser.com/>.
 20. Shiva argued that her verbal guarantee that she wanted to participate in the project should be sufficient—a guarantee that she made on film.
 21. Personal communication with author.
 22. This was an ultimately unsuccessful attempt by organic farmers in Saskatchewan to launch a class action lawsuit against Monsanto and Bayer CropScience in order to claim damages for the contamination of organic canola by the genetically engineered canola varieties marketed by these two companies.
 23. Since 1995, the Coalition Against Biopiracy has been holding the “Captain Hook Awards for Biopiracy.” This annual global award ceremony recognizes the work of the most courageous cogs (this term comes from the Middle Ages when small ships known as cogs were constructed with high sides to provide some degree of protection from marauding pirates) battling against biopiracy while also bestowing citations of shame on those groups and organizations that have committed the most heinous acts of biopiracy.

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