

Articles

The Corporate Corruption of Academic Research

Jamie Brownlee¹

ABSTRACT: In Canada, and elsewhere, universities are becoming increasingly corporatized. This paper explores one aspect of the corporatization process: how university research has been transformed. I provide a detailed analysis of how corporate influence has corrupted academic research, from the selection of research topics, to research secrecy, through to how conflicts of interest and research bias influence the collection and release of information. As part of my analysis, I include an in-depth case study of biomedical research and academic medicine to show how the corporatization of higher education has led to systematic research bias and compromised the values that have historically defined scientific research. For universities and the medical profession, corporatization has produced a crisis of credibility in the published literature and tarnished the academy as a source of disinterested knowledge. For the public, the consequences run much deeper. I conclude by locating the corruption of academic research in the fundamental antagonism between corporate and academic institutions.

KEYWORDS: Corporatization, Conflicts of Interest, Research Bias, Biomedical Research, Academic Medicine

INTRODUCTION

Supporters of the corporatization of higher education present the benefits of university-industry research ties in clear, decisive terms. These purported benefits include financial support for universities, commercially valuable product development, faculty access to research and development opportunities, enhanced technological innovation and scientific progress. Some even claim that industry funding and public-private partnerships enhance customary measures

¹ Jamie Brownlee (jamie.brownlee@carleton.ca) teaches in the Department of Law and Legal Studies, Carleton University. He is the author of *Ruling Canada: Corporate Cohesion and Democracy*.

of academic quality, such as publication productivity (Crespo and Dridi, 2007). In contrast, I argue that the corporatization of academic research has not been beneficial for universities or for society. On the contrary, it has reduced researchers' ability to pursue independent lines of scholarship, compromised the values and practices that have historically defined scientific and other academic research, and tarnished the university as a site of unbiased inquiry. Using this position as a starting point, this paper explores how university research has been transformed – and the public interest threatened – by the corporatization process. I provide a detailed analysis, including an in-depth case study of academic medicine, of how corporate influence has, in effect, corrupted academic research, from the selection of research topics, to research secrecy, through to how conflicts of interest and research bias influence the collection and release of information. I conclude by locating the corruption of academic research in the fundamental antagonism between corporate and academic institutions, while advancing the need for radical changes to the corporate-academic research interface.

SELECTION OF RESEARCH TOPICS

Corporate influence crosses all aspects of the academic research process, including at the outset with the selection of research topics and projects. Rather than setting their own research agendas in response to social needs, academics are increasingly joining with partners from the private sector to define their research priorities. As a result, the basis for deciding what knowledge is worth pursuing is defined more and more by the criteria of corporate demand. Many areas of university research have been affected by this shift. In agricultural research, for example, the influence of agrochemical companies has moved research agendas in the direction of resource intensive production technologies, genetic engineering and chemical-based pest and weed control. In the latter case, hundreds of millions of dollars are being allocated to the development of new toxic pesticides in university labs, while the study of biological control – the discipline of controlling agriculture pests through means other than pesticides – has all but disappeared. Likewise, because of their dependence on industry funding, the research of most weed scientists centres on chemical herbicides rather than alternative forms of management like biological

control and crop rotation strategies.² According to John McMurtry (2009, 17), independent agricultural research in areas such as “integrated pest management, organic farming for productive efficiency, management-intensive grazing, small-scale producer cooperatives, alternatives to factory-processed livestock and avoidance of ecological contamination by genetically-engineered commodities” have been “silently selected out” of universities because corporations are not interested in funding them.

The same is true in many areas of health research. In recent years, far more resources have been put into investigating the cellular/genetic basis for cancer than into environmental factors, which are now widely recognized to be key determining factors. Not only are corporations unwilling to fund research into the linkages between cancers and industrial toxins, they have also made a concerted effort to suppress academic research that demonstrates any kind of causal relationship. In the same way, corporate and government funding programs have worked to redirect cancer research from causes to cures (Thompson, 2008). It is often claimed that without the money and support of large corporations, universities would lack the capacity (and the incentive) to produce new life-saving drugs, medicines and therapies. The reality, however, is quite different. Corporate influence has diverted academic attention away from vaccine research and diseases that affect the world’s poor (e.g., malaria, schistosomiasis, tuberculosis and dengue fever). In fact, a recent study of the top 54 Canadian and US research universities found that less than 3 percent of research funding is devoted to diseases that affect the world’s poorest people. The report also notes that more than a billion people currently suffer from “neglected diseases,” or diseases that are “rarely researched by the private sector because most of those affected are too poor to provide a market for new drugs” (Universities Allied for Essential Medicines, 2013, para. 8). For commercial reasons, the vast majority of research investments by the pharmaceutical industry (and increasingly universities) focus on what are called “lifestyle drugs” – high-profit treatments for obesity, baldness, wrinkles and sexual dysfunction. Of course, the impact of corporatization on academic research agendas is not limited to the sciences. In her work, Lauren Snider (2000; 2003) has documented a precipitous decline in social science research on corporate crime in Canada and elsewhere. She attributes this decline

² Nearly two decades ago in *Toxic Deception*, Dan Fagin and Marianne Lavell (1996, 52) quoted the former president of the Weed Science Society of American as stating: “If you don’t have any research [funding] other than what’s coming from the ag[ro] companies, you’re going to be doing research on agricultural chemicals. That’s the hard, cold, fact.”

to the unwillingness of private sponsors and governments to fund this type of research, and to political pressures both inside and outside of the academy.

In some ways, academics may be viewed as victims in this process. University researchers are under intense pressure to secure outside funding and many would be unable to continue their research programs without such support. A recent survey by researchers at the Ontario Institute for Studies in Education, for example, found that three quarters of Canadian academics said that pressures to raise external funds had increased since their first appointment (Tamburri, 2012). Furthermore, the distinction between research choices made out of scholarly interest and those made because of funding availability is not an easy one to draw. Many academics believe they are engaging with particular topics out of their own free choice when in reality they are often “adjusting their curiosities” to match the interests of available sponsors. According to Jeff Schmidt (2000), many funders are aware that they can arouse the necessary interest in academic circles without formally dictating research priorities. On the other hand, academics are also active participants in the selection of their areas of research. The fact that so many of them acquiesce to (or embrace) corporate lines of research suggests a high level of conscious complicity. As Claire Polster (2000, 30) explains, many Canadian scholars freely admit to doing “whatever it takes” to strengthen their granting performance, including “switching their research topics to well-funded areas in which they often have lesser expertise.” In sum, although corporate-university ties may reduce the ability of some academics to engage in alternative or critical research agendas, the selection of research topics are moral and political *choices* that cannot simply be blamed on financial necessity or the demands of funders.

RESEARCH SECRECY

Universities have traditionally been an important source of the knowledge commons, which Jennifer Sumner (2008, 193) defines as “cooperative human constructions that protect and/or enable universal access to the life good of knowledge ... This knowledge is shared, not privatized, packaged, priced, and profited from.” Similarly, David Bollier (2002) describes the academy as a “gift economy.” The gift economy of academia presumes that research and scholarly resources are produced in accordance with publicly articulated purposes, and supported by the free production and circulation of

knowledge, both within and outside of the university. For Bollier, gift economies are “potent systems for eliciting and developing behaviors that the market cannot,” such as honesty, information sharing and mutual collaboration (30). In their seminal work on the scientific enterprise, Robert Merton (1973) and Michael Polanyi (1969) reached similar conclusions about the nature of academic research. Both argued that the products of research should be open and shared and that researchers should be primarily disinterested or motivated by a commitment to advance knowledge rather than personal or financial gain. These are not simply proscriptions for the way academics ought to behave; rather, the open and disinterested nature of academic inquiry is precisely what makes it so innovative. As Jennifer Washburn (2005, 195) explains, the system “does a remarkably good job of speeding the creation of new discoveries, hastening public disclosure, and enabling peers to evaluate and replicate new research findings to ensure their accuracy – all of which helps to broaden the stock of reliable public knowledge that is available for future research and innovation.” These concepts – of knowledge commons and gift economies – are idealized terms. Research secrecy has always had a place in academia, as some professors have always been reluctant to share ideas out of fear that they will be appropriated by others. Nonetheless this practice runs counter to academic ideals and has increased under corporatization.³

One of the ways that corporatization has fostered academic secrecy is through the creation of a more competitive, utilitarian and performance-based research culture. For example, as publication productivity becomes more important for academic appointment and promotion there are fewer incentives for collaboration and knowledge sharing among researchers. The same is true for graduate students, whose PhD experiences increasingly resemble competitive self-marketing marathons. And, as noted above, greater pressures has been placed on faculty to obtain external grants, which has helped to transform the university from a knowledge sharing institution to a site of competitive fundraisers. As Polster (2007, 610) discovered in her research, the importance placed on grant acquisition “is reducing some colleagues’ willingness to support one another in a variety of ways, such as reading or discussing research

³ Some have been particularly critical of academics who keep research findings secret. “Like a lie,” writes Robert Wolff (1969, 129), “the commitment to secrecy sunders the moral bond between the members of the university.” A person who keeps their research secret “is no more capable of entering genuinely into the public discourse of the university than is an FBI agent posing as a student radical.”

proposals and papers. It is also taking a toll on academic collegialism and morale.”⁴ Polster also found that there is a growing tendency for Canadian academics to avoid scientific conferences for fear of disclosing valuable information and, when they do attend, these “private academics” often refuse to provide details of their research or engage in discussions that might compromise funding or commercial interests (Polster, 2000).

In addition to these pressures, corporate funding and public-private partnerships contribute to research secrecy more directly, including through non-disclosure and intellectual property (IP) agreements. Whereas academic secrecy is often a short-term expedient to ensure publication, commercial secrecy via IP arrangements can be a lengthy process that remains in place for as long as proprietors deem it to be in their interest. In some cases, contractual arrangements can force academics to transfer the results of their research to the firms who paid for it. In others, the publication of findings may be delayed until a corporate sponsor obtains a patent on its IP. Selective disclosure and withholding of data may also occur if the research results are potentially damaging to the corporate bottom line. Efforts to maintain research secrecy by certain industries, such as the pharmaceutical industry, are especially harmful, with some companies using “gag orders, appealing to trade secrets, concealing [drug risks] behind a veil of attorney-client privilege, settling legal actions out of court to hide data and documents, [and] stalking and harassing academic critics” (Healy, 2012, 119). A recent example of how corporate influence leads to research secrecy involved the oil giant British Petroleum (BP). In the first few months after the Gulf oil disaster in 2010, BP enlisted academic scientists into exclusive research and consulting contracts that were replete with secrecy clauses and barred them from making their findings public (Lea, 2010). Not only was BP attempting to subvert the scientific process, but it was putting measures in place to ensure it would control academic data and evidence about the disaster. This example, and others like it, demonstrates how corporate-university alliances have the potential to stifle research in the public interest.

Of course, it is not just the proprietary control of capital that is responsible for IP-related secrecy in higher education. It has also resulted from the autonomous initiatives and commitments of academic actors. For much of the twentieth century, academics (and universities) did not consider research-related IP as an opportunity for economic enrichment.

⁴ This increased emphasis on “performance” and competition in university research has been well documented at some institutions, such as the University of Ottawa, where reduced collegiality was identified as one of the most noticeable consequences (Chan and Fisher, 2008).

In fact, limiting scholarly or public access by commercializing research results was regarded as a suspect practice, or worse.⁵ However, these ideas about the role of IP in higher education have since largely been abandoned. Under corporatization, “academic capitalists” within the university have become far more aggressive about pursuing the material benefits of knowledge production, including by embracing IP agreements (Slaughter and Rhoades, 2004). This trend highlights the active, sometimes leading, role that professors and administrators can play in corporatizing university research.

Although the extent of research secrecy in Canada is not well documented, this topic has been explored extensively in the US. To summarize the literature, US research suggests that researchers with industry support are more likely to (i) report that “trade secrets” resulted from their research (information kept secret to protect its proprietary value); (ii) be denied the information/data necessary to publish their results; (iii) delay publication of their research; and (iv) deny other academics access to their data and research findings (Krimsky, 2003; Washburn, 2005). Research also suggests that graduate students may be especially vulnerable to secrecy agreements because they rely on the prompt publication of their findings in order to secure funding or employment, yet they are often prevented from publishing in a timely fashion or even from completing their projects. In one Harvard study, researchers found that 88 percent of life sciences companies reported that their university contracts required graduate students and postdoctoral fellows to keep information confidential (Blumenthal, Causino, Campbell, and Louis, 1996). A more recent investigation of graduate students and postdoctoral holders in computer science, chemical engineering and the life sciences found that one in four had been denied information relevant to their research, and this was especially prevalent in research groups with links to industry (Holden, 2006).

To summarize, research secrecy is incompatible with academic values and has negative implications for researchers, universities and the

⁵ Many renowned university inventors who were formally entitled to patent royalties, for example, did their best to avoid personal remuneration, preferring to channel the obligatory profits back into their laboratories. Others resisted patenting altogether. For instance, when Jonas Salk discovered the polio vaccine in 1954 (an invention clearly worth millions), he did not patent the vaccine because he believed that no individual should own or profit from discoveries made about the natural world. Similarly, Stanley Cohen and Herbert Boyer, who discovered the gene-splicing technique in 1973, resisted patenting because they recognized that their discovery depended upon the freely available work of other scientists. In short, the prevailing academic view was that knowledge should be placed in the public domain without proprietary restrictions.

public at large. Within the academy, secrecy disrupts collegial relationships, reduces knowledge sharing and promotes waste as researchers needlessly duplicate work that was not made freely available. Secrecy also restricts the course of knowledge production because scientific progress depends on researchers building on the findings of others. IP protections such as patents, for example, are highly protectionist and tend to stifle innovation by restricting the diffusion of knowledge both to and from universities (Murray and Stern, 2007; Rosell and Agrawal, 2009). According to Mike Lazaridis (2004, 2), former President and Co-CEO of Research in Motion, “patenting is an inherently secretive process requiring its proponents to withdraw from the very processes that expand and transfer knowledge in a research university – open disclosure, peer review, and publication in scientific journals.” Most importantly, research secrecy inhibits the amount of knowledge that is available in the public domain, including in areas such as food production and medicine. Jennifer Washburn (2005) has reported that roughly one quarter of patented inventions in agricultural biotechnology – which have been tied up under restrictive commercial agreements – originated in public institutions at public expense. The same is true of many medicines (e.g., AIDS drugs) and even human genes, which have been patented and exclusively licensed to biopharmaceutical companies (e.g., the gene responsible for hereditary breast cancer). As universities and academics are increasingly guided by market logic, research secrecy will continue to present a serious threat to the public interest.

CONFLICTS OF INTEREST AND RESEARCH BIAS

The corporatization of the academy has brought about other changes in the university research process, including conflicts of interest and research bias. In general, a conflict of interest occurs when a person is inclined or obliged to pursue interests that compete with one another in a fundamental way. More specifically for the purposes here, conflict of interest situations are those in which financial or other personal considerations may compromise a researcher’s professional judgement in considering or reporting research results. An obvious group who are affected by conflicts of interest are senior academic economists in the US (and elsewhere) who occupy lucrative and high ranking positions in governments and/or major financial institutions. As Charles Ferguson (2010) observes, “the economics profession – in economics departments, and in business, public policy, and law schools – has become so compromised by conflicts of interest that it now functions almost as a support

group for financial services and other industries whose profits depend heavily on government policy.” Ferguson adds that the build-up to the 2008 financial crisis “runs straight through the economics discipline” (para. 12). What is particularly noteworthy about academic conflicts of interests is that they are rarely disclosed. For example, one study examining 62,000 articles in 210 scientific journals found that only one half of one percent included relevant information about authors’ research-related financial ties, even though all of the journals formally required such disclosure (King, 1999). Conflicts of interest may be especially damaging for universities; short of outright fraud, nothing is as threatening to the integrity of the university than the perception that it has been bought off.

There is no shortage of scholars who, by virtue of their corporate and other connections, are affected by conflicts of interests. One of the main consequences of this conflict is the resulting research bias. In some cases, research bias results from direct corporate censorship or academic corruption. For example, one study of university-industry engineering research centres in the US found that 35 percent allowed corporations to delete information from papers prior to publication (Washburn, 2005). Likewise, a small minority of academics have deliberately falsified results to produce findings that accord with their interests or those of their sponsor. However, a much more prescient cause of research bias is the *unconscious* effect of financial benefit or career advancement. The logic is simple: researchers with a vested interest in reaching a particular conclusion will tend to weigh arguments and evidence in a biased fashion. The mechanisms though which this occurs are varied and subtle, including how questions are framed, how studies are designed, how contrary interpretations are emphasized and how conclusions are worded. Complicating matters is that the vast majority of academics perceive themselves to be objective and impartial, and corporate sponsors often recognize the importance of encouraging researchers to “feel” impartial (Freudenburg, 2005). In any event, a substantial body of empirical evidence indicates that even if corporate sponsors allow researchers free reign over the research process – which they often do not – projects financed by big business are far more likely to reach conclusions that support the interests of their sponsor.

Many areas of academic research have been affected by research bias. One of the most obvious examples is food and nutrition. Researcher Marion Nestle (2007) has documented the extensive network through

which food companies sponsor nutrition research, nutrition conferences, food and nutrition journals and the activities of professional societies. As a result, research findings in this area often favour the interests of their sponsors. In fact, Nestle argues that sponsorship almost invariably predicts the results of research into specific foods or nutrients. Similarly, Lesser, Ebbeling, Goozner, Wypij, and Ludwig (2007) looked at studies on the relationship between soft drinks and childhood obesity. They found that while independent studies almost always find an association between habitual consumption of soft drinks and obesity, industry-sponsored studies rarely do.

Tobacco research offers another example of how industry funding distorts the research process. One study found that 94 percent of articles that had authors who were affiliated with the tobacco industry concluded that second hand smoke was not harmful. In contrast, only 13 percent of articles where the authors had no tobacco ties reached the same conclusion (Barnes and Bero, 1998). When the researchers ran a multivariate regression controlling for other variables (article quality, peer review status, article topic and year of publication), having an author with a tobacco-company affiliation was the *only* variable associated with the conclusion that second-hand smoke is not harmful. The basic strategy of the tobacco industry has been to use university scientists to make the dangers of cigarettes appear controversial. These companies depend on the fact that observers tend to associate academic research with independence and impartiality. Of course, this is not only true of tobacco companies; “decency by association” is one of the reasons why most corporations that produce harmful products or engage in destructive practices actively seek academic partnerships. In the area of climate science, for instance, this is precisely why “academics”, and not the president of Imperial Oil, are chosen to deliver the message that global warming is not occurring” (Gutstein, 2009, 305). The ability of the tobacco industry to downplay the risks of tobacco consumption partly resided in the extensive network of ties it had created with medical researchers (Cohen, 2008; Kaufman et al., 2004). Although these relationships have dissipated in recent years, the same cannot be said about the relationship between academic medicine and the pharmaceutical industry. More than any other area of academic research, conflicts of interest in biomedicine are threatening the health and well-being of people around the world.

BIG PHARMA, BIOTECHNOLOGY AND THE PERVERSION OF ACADEMIC MEDICINE

Historically, medical schools and researchers advanced medical science (and built their reputations) by maintaining clear boundaries between the academy and industry. In the area of pharmaceuticals, academic distrust of business ran especially high (Atkinson-Grosjean and Fairly, 2009). In Canada, this changed in the late 1980s when government support for medical research declined and medical schools embraced the pharmaceutical industry as a way to maintain a stable influx of new funds. These efforts were facilitated in 1992 by the creation of the Council for Biomedical and Health Research, which brought together the Association of Canadian Medical Colleges (representing 16 university faculties of medicine), the Canadian Federation of Biological Societies and the Health Research Foundation of the Pharmaceutical Manufacturers' Association to generate public support for drug-related research. At the same time, the field of biotechnology expanded in Canadian universities and set the stage for widespread commercial involvement in biomedicine. Over the past few decades, the life sciences – mostly represented by biotechnology – has accounted for a disproportionate share of Canadian universities' commercial output (Niosi, 2006).

Today, the association between Big Pharma, medical science and university facilities and researchers is well established. Drug companies spend billions each year wooing physicians (more than they spend on consumer advertising or research) in order to generate support for their products, align medical research with corporate interests, and amass a network of well-respected consultants and lobbyists. According to one estimate, 94 percent of psychiatrists-in-training have accepted gifts from pharmaceutical firms by their third year (Ferrie, 2013). Further, Canadian medical researcher Joel Lexchin (2010) notes that drug companies in Canada spend between \$2.4 and \$4.8 billion annually pushing their drugs to doctors. These figures are not surprising, considering that doctors have sole prescription power over some 20,000 pharmaceutical drugs that generate hundreds of millions of prescriptions every year. According to psychiatrist David Healy (2012, 8-9), the industry monitors the prescribing habits of doctors in the Western world, and data on who prescribes what is used by corporations to shape their marketing strategies. The fact that drugs are made available on a prescription-only basis has put a "relatively small group of people with no training in or awareness of marketing techniques – doctors – in the gun sights

of the most sophisticated marketing machinery on the planet.”⁶ The pharmaceutical industry also provides hundreds of millions of dollars in financial subsidies to medical journals via the purchase of advertisements, special supplements and reprints, and it spends billions more on continuing medical education (CME) programs. The proportion of CME programs that are funded by industry has climbed steadily in recent years (Elliot, 2010). Sales and marketing divisions dominate corporate decision-making around the distribution of CME money because the primary goal of these “public service” programs is to push new drugs (Ridgeway, 2010).

Through these marketing and outreach efforts, corporations have infiltrated medical schools. In the US, for example, one survey found that nearly two thirds of department heads at medical schools and teaching hospitals had financial or other ties to industry (Mangan, 2007). According to the *New England Journal of Medicine*, a national sample of over 3,100 US physicians revealed that 94 percent were involved with drug companies and 28 percent were paid consultants for the industry (Campbell et al., 2007). A further set of connections involves the millions of clinical trials for drugs and other medical treatments that are conducted in academic medical centres around the world. Industry funds approximately 70 percent of all clinical trials and 70 percent of these are run by contract research organizations that produce data that is wholly owned by their sponsors (Sismondo, 2009a). Although clinical trials are ostensibly “research” activities, a large proportion amount to marketing exercises and commercial product testing. Remarkably, even members of institutional review boards and committees, whose job it is to “police the researchers” and protect human participants in medical trials, have extensive conflicts of interest because of their relationships with the drug industry (Brainard, 2006; Campbell et al., 2003). A recent study of 288 panel members responsible for clinical practice guidelines in Canada and the US found that over half of these individuals had financial conflicts of interest (Neuman, Korenstein, Ross and Keyhani, 2011).

As this cursory review makes clear, a myriad of potential conflicts and inherent tensions are involved in the relationship between corporations, the medical profession and biomedical researchers. In fact, medical journal editors now frequently complain that they can no

⁶ For example, Healy notes that marketers have learned to distinguish between “high-flyers,” “sceptical experimenters,” “rule-bound” and “silent majority” doctors (55). Each of these groups is targeted differently by marketers in an effort to direct the prescribing habits of physicians.

longer find academic experts without conflicts of interest.⁷ The most common conflicts are financial in nature; these range from the provision of “hands-off” corporate sponsorships to situations where researchers hold a personal financial stake in their research outcomes. The latter case is especially troublesome, yet surprisingly common. In his seminal study, Sheldon Krimsky and his colleagues (1996) looked at the industry connections of the authors of 789 scientific papers published by 1,105 researchers in 14 major life science and biomedical journals. The study found that 34 percent of the articles (267) had at least one lead author with a financial interest in the outcome of the research (not one article disclosed this interest).⁸ Moreover, the 34 percent figure likely under-represented the actual level of conflict of interest because the researchers were unable to account for certain variables, such as authors who received consulting fees from companies involved in commercial applications of their work. Shortly after the release of Krimsky’s findings, the leading life sciences journal *Nature* published a statement in which it acknowledged that financial conflicts of interests were common in biomedical research, but asserted that this was of little consequence. According to the journal, Krimsky’s study provided no evidence that the “undeclared interests led to any fraud, deception or bias in presentation, and until there is evidence that there are serious risks of such malpractice, this journal will persist in its stubborn belief that research as we publish it is indeed research, not business” (Avoid Financial ‘Correctness,’ p. 469).

Since *Nature*’s aggressive rejoinder, an abundance of evidence has been accumulated supporting the hypothesis that corporate funding and conflicts of interest are associated with research bias in the medical field. This pattern holds not only for research where investigators have a personal stake in the outcome, but for industry-sponsored studies more broadly. For example, Mildred Cho and Lisa Bero (1996) found that 98 percent of drug studies funded by pharmaceutical companies reached

⁷ Ellen Schrecker (2010) recounts an incident where the *New England Journal of Medicine* decided to ban authors with a financial interest in any company (or its competitor) that made a product discussed in the author’s work. It eventually had to add the word “significant” because the editors could find only one submission over the previous two years that complied with the requirement. Likewise, the *Canadian Medical Association Journal* attempted to implement a similar conflict of interest policy but the editors could not find enough qualified researchers that did not have ties to drug companies. For additional examples, see Washburn (2005: Chapter 5, note 9).

⁸ “Financial interest” in this study included (i) serving on a scientific advisory board of a biotechnology company that develops products in the area related to the scientist’s research; (ii) holding a position as an officer, director or major shareholder in a company whose products are related to the scientist’s research; and/or (iii) possessing a patent or a patent application closely related to the scientist’s work.

favourable conclusions about drug safety and efficacy, compared with 79 percent of studies not funded by industry. Another investigation found that studies of cancer drugs funded by drug companies were nearly eight times less likely to reach unfavourable conclusions compared with similar studies funded by non-profit organizations (Friedberg, Saffran, Stinson, Nelson and Bennett, 1999). Similarly, medical researchers in Toronto reported a strong association between purported drug safety and financial conflicts of interest (Stelfox, Chua, O'Rourke and Detsky, 1998). More specifically, they found that 96 percent of authors whose findings supported the safety of a particular class of drugs had a financial relationship with the drug manufacturers, compared with 60 percent of "neutral" authors and 37 percent of authors who were critical of the drugs' safety.

More recently, several meta-analyses of the biomedical literature have provided compelling evidence about the linkages between industry funding and research bias. The first by Justin Bekelman, Yan Li and Cary Gross (2003), looked at research published over a twenty-three year period on the extent, impact and management of conflicts of interest in biomedical research. They found a strong and consistent correlation between industry sponsorship (mainly, but not all pharmaceutical) and pro-industry conclusions. In a similar review, Lexchin, Bero, Djulbegovic and Clark (2003) found that studies funded by pharmaceutical companies were far more likely to have outcomes favouring their sponsors than studies sponsored by other organizations, and that "systematic bias" favours products that are made by companies funding university research. Some years later, Sergio Sismondo (2008) found that 17 out of 19 studies investigating the effects of drug company sponsorships showed an association (usually a strong association) between industry sponsorship and pro-industry conclusions.⁹ Taken together, these studies illustrate the impact of corporate power in academic medicine and the important differences between publicly funded versus privately funded research.

It should be noted that in addition to research bias, outright research fraud is also on the rise. One recent review of survey research on scientific misconduct found that falsifying data is far more common than

⁹ Within this larger review, Sismondo (2008) reports that of 100 articles published in the pulmonary/allergy literature, 98 percent of articles sponsored by drug companies reported findings that were favourable to the drug being studied (compared with 32 percent of other articles). Moreover, in a sample of 542 articles on clinical trials in psychiatry, 78 percent of sponsored studies favoured the sponsor's drug versus only 48 percent of those without industry sponsorship.

previously estimated, and that this form of misconduct is reported most frequently in the case of medical and pharmacological research (Fanelli, 2009). Approximately one third of respondents in the study admitted to some form of questionable research practice, such as altering the research design, methodology or results in response to pressures from funders. More evidence of biomedical fraud came to light in 2012, when a team of 100 scientists tried to replicate the results of 53 of the most widely cited cancer research papers. This effort resulted in only six research studies being validated, while the rest could not be replicated. Many of the studies were apparently bogus (Sharav, 2014). “Shockingly,” writes medical journalist Helke Ferrie (2013, 284), “this was not Pharma-generated junk science, but came from university researchers who misled companies wanting to use their research for new cancer drugs. Indeed, there is no honour among thieves.” These studies of research fraud support the growing consensus that Big Pharma funding and partnerships in academic medicine is distorting scientific evidence to promote commercial interests.

Corporate funding and conflicts of interest help to explain the preponderance of research bias in academic medicine, but it is not the whole story. Under corporatization, academics are increasingly ceding control over every stage of the clinical research process.

GHOST-WRITING AND GHOST-MANAGEMENT

Within the biomedical literature, corporate employees routinely write “academic” papers that emerge from corporate-sponsored research. This practice – often referred to as “ghost-writing” – generally works as follows: when research results are ready to be written up, a corporation’s marketing department will contract with medical writers from a public relations or “medical communications” firm to produce a manuscript. After several drafts have been completed, the manuscript is then inspected by the company’s marketing and legal departments for approval. It is usually around this time that an academic “author” will inspect and sign off on the article. When the article subsequently appears in a pre-selected journal, the ghost-writer(s) either disappears or is subtly acknowledged as providing some form of editorial assistance. Frequently, the academic who assumes authorship will not have had access to the data on which the study is based and, in some cases, is simply paid to have his or her name appear on the publication. The compensation rates for professors who participate in ghost-writing generally range from \$1,000 to \$2,500 per article; however, payments

can be as high as \$10,000, especially if the writer presents the findings at conferences or in medical education lectures (Elliot, 2010; Krinsky, 2003). Meanwhile, professional ghost-writers are often paid between \$10,000 and \$20,000 per article and have annual salaries that can exceed \$100,000 (Mirowski and Van Horn, 2005; Schafer, 2004).

How prevalent is ghost-writing in the medical literature? Given the inherent secrecy of the process, firm data are not available. Evidence suggests, however, that the practice is commonplace, and even extends to medical textbook publishing (e.g., Basken, 2009; Lacasse and Leo, 2010; Wilson, 2010). In fact, according to one study, the *majority* of articles on lucrative pharmaceutical drugs in leading medical journals are likely to be wholly or partially ghostwritten (Healy and Cattell, 2003). It is important to note that many ghost-writing campaigns are launched (or continue) after evidence of dangerous or deadly drug side effects are produced. Examples include Wyeth (now part of Pfizer) and the hormone replacement drugs Prempro and Premarin (breast cancer, heart disease, stroke); Eli Lilly and the antipsychotic drug Zyprexa (obesity and diabetes); and GlaxoSmithKlein and the antidepressant Paxil (suicidal ideation in children) (Elliot, 2010). Healy has even suggested that in some areas – such as on-patent drugs and the safety/effectiveness of antidepressants for children – virtually all of the published literature includes material that is authored by medical writers or pharmaceutical company personnel (Fine, 2009; Healy, 2008; 2012). It follows that studies of antidepressants in children “offer the greatest known divide in medicine between what published reports in the scientific literature say on the one side and what the raw data in fact show” (Healy, 2012, 149). As Healy documents, what the studies say is that these drugs are remarkably safe and effective. In contrast, the data show that children are killing themselves at a much higher rate while they are on some of these drugs. For years, psychiatric drugs prescribed to children and adolescents have been associated with a long and adverse list of physical and emotional effects (Whitaker, 2010). If medications that carry a high risk of disability and death in children are considered fair game for this kind of corporate-academic fakery, it would appear that there are few, if any, limits.

As disturbing as these practices are, ghost-writing is only one part of an increasingly sophisticated system of “ghost-management” in medical research (Sismondo, 2007; 2009b). Ghost-management refers to the broader phenomenon whereby drug companies and their agents direct and shape the entire research process, from funding and design to publication and promotion. This process often begins before the onset of the

research trials when company officials, in consultation with “publication planning” companies, shape the research design. The corporations participating in these networks sometimes manipulate trial design in ways that escape detection by peer review processes, including by conducting a trial drug against a treatment known to be inferior, excluding placebo responders, and testing a drug against too low a dose from a competitor’s drug (Smith, 2005). Many companies also conduct multicentre trials and artificially select for results that are favourable to their interests. In fact, 30 to 40 percent of clinical trials are never reported on because they fail to produce the “correct” results (Healy, 2012; Kirsch, 2010).

Before and during the trials, the corporate network will select target journals and audiences, anticipate peer-review criticism and identify which academics (ideally key “opinion leaders”) are going to be included as authors. Some of these opinion leaders – who are often considered the most distinguished in the field – are creations of the pharmaceutical industry. In part, this is because they are repeatedly selected for ghost authorship, meaning their names may appear on 800 to a 1000 articles (Healy, 2012). In addition to these recruitment efforts, industry can also fund their research and travel, make them investigators on clinical trials, put them on scientific programs, and arrange for them to present at continuing medical education events (Elliot, 2010). It is especially important for publication planners to get involved early if “there is a need to create a market or to create an understanding of unmet need,” otherwise known as “disease mongering” or “selling sickness” (Sismondo, 2009b, 177). A well ghost-managed publication may also include the targeting of conferences and professional meetings where results can be advertised, and the development of other communication opportunities such as “symposia and round-tables, journal supplements, advisory board meetings, slide programs, formulary kits, and more” (Sismondo, 2009b, 176).

The size of the publication planning industry continues to grow. Over 50 different agencies now openly advertise publication planning services, and many of them boast of having hundreds of employees who handle hundreds of manuscripts each year. In fact, the industry is large enough that two international associations of publication planners exist to organize seminars and meetings (the International Society of Medical Planning Professionals, and the International Publication Planning Association). According to Sismondo (2009b, 172), up to 40 percent of “important journal reports of clinical trials of new drugs (and, more anecdotally, perhaps a higher percentage of meeting presentations on clinical

trials) are ghost-managed through to publication.” As a result, not only are most published reports of clinical trials likely to be ghostwritten in some way, but roughly a quarter of published trials are altered so that a negative result for a drug will have been transformed into evidence that the drug is effective and safe (Healy, 2012).

The large number of medical writing and medical education and communication firms, whose tasks are generally limited to ghost-writing and preparing presentations, may be viewed as adjuncts to the more sophisticated work of publication planners. Medical journals should not be seen as dupes in this process, as many editors have extensive dealings with medical writers and publication planners and are fully aware of the process. Ghost-management and publication planning have as a primary goal the extraction of monetary value from scientific research. Needless to say, they amplify research bias because commercial interests are involved at virtually every stage of the research process. These practices should not be seen as a breakdown of ethical standards or editorial oversight; on the contrary, this is a well-organized industry that forms an integral part of the corporate production of knowledge.

ASSESSING THE IMPACT

The corporatization of academic medicine has had a profound impact on researchers, universities and the public. For researchers, it has reduced their ability to pursue independent lines of scholarship, increased restrictions on academic freedom and, in some instances, resulted in severe consequences for scholars who defy this corporate-university complex. The high profile cases of Nancy Olivieri and David Healy in Canada, the details of which have been amply documented elsewhere, are cases in point.¹⁰ For universities and the medical profession, it has produced an unprecedented crisis of credibility in the published literature and severely tarnished the academy as a source of unbiased research. The public impact, however, goes much deeper. For one, underwriting the

¹⁰ For firsthand accounts, see Olivieri (2000) and Healy (2008). For useful overviews, see Schafer (2004) and Woodhouse (2009: Chapter 3). What was most disturbing about the two cases was not the behaviour of the drug companies but the behaviour of the university. When Olivieri and Healy were removed from their positions at the University of Toronto, university and hospital officials failed to recognize – or, at least, failed to acknowledge – that their actions represented outrageous violations of academic freedom. The treatment of Olivieri was especially heinous. Professor Margaret Somerville, Founding Director of the Faculty of Law’s Centre for Medicine, Ethics and Law at McGill University, has stated that the Olivieri case “reads like a horror story on the involvement of corporations in university-based research” (as cited in Woodhouse, 2009, 109). Both cases would eventually become flashpoints for larger political debates about whistle-blowers and the influence of corporate money in academic medicine.

costs of drug research is a costly venture. Canadian taxpayers pay most of the costs of discovering and developing new drugs, and they pay again as consumers for mass marketed treatments that offer little or no benefit. Evidence from France and Canada suggests that no more than 15 percent of new drugs represent any significant therapeutic advantage over those that already exist (Lexchin, 2010). Likewise, some widely used drugs such as antidepressants have been shown to be only marginally more effective than placebos (Kirsch, 2010).

There are also severe risks associated with corporatized medical research. Not only are violations of human research protection rules on the rise, but there is reason to believe that adverse trial events are increasingly treated as “confidential commercial information” and never made public (Washburn, 2005). As well, the many drug scandals that have erupted in recent years illustrate the human toll that can result from corporate sponsorships, compromised clinical trials, research bias and data suppression. In the case of Vioxx, for example, millions of people took the drug before it was exposed as causing a serious risk of heart attack and stroke, a fact that was known to academic and corporate researchers but explained away and eventually suppressed (Schafer, 2008). One estimate suggests that half a million premature deaths in the US alone may have been caused by Vioxx use (Cockburn, 2012). Compromised research and publishing practices also explain, in part, why hundreds of thousands of Americans die each year from “correctly” prescribed drugs (Starfield, 2000). Using data from the Canadian Medical Association, Ferrie (2009) asserts that the comparable figure for Canada is at least 23,000 annually, which represents only the incidence of *reported* deaths. Moreover, the number of adults and children disabled by mental illness continues to rise, with some researchers concluding that pharmaceutical drugs are fuelling, rather than alleviating, the epidemic of mental illness (Whitaker, 2010). With approximately 20 percent of the North American population currently consuming pharmaceutical drugs for anxiety, depression, and other ailments, and with pharmaceuticals and medicine accounting for the largest number of industry-sponsored research contracts in Canadian universities, these issues could not be more pressing (Council of Canadian Academies, 2012).

While there has been some effort to address these problems on the part of medical schools and journals in recent years, most research universities and medical centres remain heavily integrated with and influenced by the pharmaceutical industrial complex. There is also increasing corporate and government pressure to reduce regulations

on drug research and eliminate independent watchdog groups.¹¹ In the corporatized university, marketing and profit continue to replace science as heavily compromised research infiltrates the peer-reviewed literature and the “knowledge” base of physicians.

CONCLUSION: THE NEED FOR RADICAL SOLUTIONS

Critics of the corporatization of higher education generally share the baseline assumption with those who support corporatization, which is that there is no alternative. Given that they see at least some degree of market restructuring is inevitable, the goal is ostensibly to “make peace” with the market while preserving academic values and some semblance of collegial governance. Former Harvard university president Derrick Bok (2003, 176), for example, notes that corporate involvement in university research may warrant radical action, but the only viable response at this point is to “tighten up the rules to limit the damage.” These critics, who often include university administrators and faculty organizations, accept corporatization as a given and focus on adapting to market forces, balancing these forces with the public interest, and finding ways to reconcile commercial and academic values. It follows that they generally advocate targeted reforms or regulatory strategies to address the problems of corporatized research. Reformist approaches call for clear rules and guidelines to “manage” the conflicts of interest inherent in corporate-university alliances and to “regulate” the contracts between researchers and business firms.

In contrast, I would argue that the corrupting influences in academic research today are located in a fundamental antagonism between corporate and academic institutions. Corporate-university conflict is exemplified by the differences between academic and industrial science. The ideals of academic research centre on disinterested inquiry and knowledge sharing, whereas industrial science tends to be motivated by financial gain and encourages research secrecy. Likewise, academic research

¹¹ In 2011, for example, the Harper government put the interests of industry ahead of patient safety when the Canadian Institutes of Health Research eliminated its internationally praised transparency requirement for full public disclosure of trial drug results. The policy, which was just three months old when it was scrapped, required scientists funded by the agency to reveal all their raw data to the public, regardless of what they chose to publish. More recently in 2013, the internationally acclaimed Therapeutics Initiative (TI) based out of the University of British Columbia had all of its funding suspended by the BC government under pressure from Big Pharma. TI had been conducting independent, evidence-based drug reviews for the BC government since the 1990s. It has been reported, for example, that TI’s work indirectly saved an estimated 500 lives in the province with its independent assessment of the drug Vioxx (Canadian Health Coalition, 2011).

relies on peer review and the replicability of results, whereas industrial research does not involve the same verification process. Moreover, the goal of academic research is to advance public knowledge, whereas industrial research aims to produce proprietary knowledge or a product that succeeds in the marketplace. In the area of scientific research at least, the cultures and practices of these two institutional spheres are fundamentally, and irreconcilably, opposed. And, interestingly, neither institution has yet to succeed when they step outside of their respective basic functions: corporations are poor performers when it comes to knowledge sharing and research integrity, and universities are equally inept when it comes to venture capitalism and generating revenue from commercialized research. This incompatibility explains why corporate involvement in university research has had such a corrosive and corrupting impact. In the words of David Healy (2012, 116-117), "insofar as commerce depends on secrecy and acquisitive self-interest rather than free communication of data and other findings, business will inevitably be as inimical to science as the Catholic Church once was to Galileo."

In my view, these deeply-rooted institutional differences suggest that reformist approaches will not and cannot address the problems facing higher education research, and that more radical approaches are necessary. In his work, Arthur Schafer (2004; 2008) notes that corporate-university partnerships are almost "preordained" to produce research findings that favour the interests of business, meaning that the proprietary interests of corporations routinely win out and any attempt to regulate or manage conflicts of interest are destined to be ineffective. Building on Schafer's analysis, I would argue that a more effective, long-term solution for addressing these problems would be an outright prohibition on corporate research funding, at least in those disciplines where the potential for harm is high. While critics of this strategy may claim that denying corporate funding on moral grounds is a slippery slope that violates academic freedom and aggravates the funding crisis in higher education, so long as faculty are not prohibited from (or penalized for) speaking, writing, teaching or researching about a particular topic, restricting a funding source does not violate academic freedom. As Krimsky (2008, 94) explains, academic freedom "is not extinguished in the case that a university community takes responsible and transparent collective action, following accepted governance procedures that prohibit certain funding from entering the university."

The suggestion to prohibit corporate funding is not to suggest that other kinds of sponsored research funding never result in problems, or

that all corporate money is detrimental. The influx of private funding for applied research has, in some instances, accelerated scientific progress to an extent that would not have been possible without such support. But the harms that result from corporate involvement far outweigh the benefits. In addition, when the actual financial costs of participating in corporate research alliances are taken into account, the monetary implications of cutting these ties for universities is far less than is commonly assumed. To participate in corporate research partnerships, universities must spend significant funds to attract sponsors, build labs, purchase equipment, and support a growing number of administrators and other specialists to help broker and negotiate complex agreements.

While a detailed exploration of this issue is well beyond the scope of this paper, it is worth noting that there has been some movement toward going beyond simply managing or regulating corporate-academic relationships. Some medical schools have restricted ties between drug companies and physicians, and have eliminated industry support for continuing medical education. Medical journals have also made some progress. The journal *Open Medicine*, for example, was formed in 2007 by former editors of the *Canadian Medical Association Journal* who resigned from their positions in part due to corporate threats to their editorial autonomy. The journal publishes its material freely online, has completely banned all pharmaceutical and medical device advertising, and has strict rules to prevent ghost-writing (Willinsky, Murray, Kendall and Palepu, 2007). Similarly, in 2009 a collection of editors from the world's leading medical journals openly called for "a complete ban on pharmaceutical and medical device industry funding" to professional medical associations. Drawing attention to the corrosive influence of corporate funding on medical science, these experts argued that "fundamental reforms" were required within medical organizations and academic medical centres in order to protect scientific integrity, patients and "the public's trust" (Rothman et al., 2009, 1368-1372). All of these initiatives point to a growing recognition that academic medicine can and should "divest" from the pharmaceutical industry entirely, and that more radical solutions to the problems associated with the corporatization of university research are required.

REFERENCES

- Atkinson-Grosjean, J., and Fairly, C. (2009). Moral economies in science: from ideal to pragmatic. *Minerva*, 47(2), 147-170.
- Barnes, D., and Bero, L. (1998). Why review articles on the health effects of passive smoking reach different conclusions. *Journal of the American Medical Association*, 279 (19), 1566-1570.
- Basken, P. (2009, September 10). 'Ghostwriting' is still a common practice, study shows. *Chronicle of Higher Education*.
- Bekelman, J., Li, Y., and Gross, C. (2003). Scope and impact of financial conflicts of interest in biomedical research: A systematic review. *Journal of the American Medical Association*, 289(4), 454-465.
- Blumenthal, D., Causino, N., Campbell, E., and Louis, K. (1996). Relationships between academic institutions and industry in the life sciences – an industry survey. *New England Journal of Medicine*, 334(6), 368-374.
- Bollier, D. (2002). *Silent theft: The private plunder of our common wealth*. New York: Routledge.
- Brainard, J. (2006, December 8). Study finds conflicts of interest on many research-review boards. *Chronicle of Higher Education*.
- Campbell, E., Gruen, R., Mountford, J., Miller, L., Cleary, P., and David Blumenthal. (2007). A national survey of physician-industry relationships. *New England Journal of Medicine*, 356(17), 1742-1750.
- Campbell E., Weissman J., Clarridge B., Yucel R., Causino N., and Blumenthal D. (2003). Characteristics of medical school faculty members serving on institutional review boards: Results of a national survey. *Academic Medicine*, 78(8), 831-836.
- Canadian Health Coalition. (2011). Funding decisions for B.C.'s drug formulary to be based on industry marketing instead of independent drug assessment. Retrieved from <http://healthcoalition.ca/wp-content/uploads/2011/03/II-BN.pdf>
- Chan, A., and Fisher, D. (2008). Academic culture and the research-intensive university: The impact of commercialism and scientism. In A. Chan and D. Fisher (Eds.), *The exchange university: Corporatization of academic culture* (pp. 49-69). Vancouver: UBC Press.
- Cho, M., and Bero, L. (1996). The quality of drug studies published in symposium proceedings. *Annals of Internal Medicine*, 124(5), 485-489.
- Cockburn, A. (2012, May 9). When half a million Americans died and nobody noticed. *The Week*. Retrieved from <http://www.theweek.co.uk/us/46535/when-half-million-americans-died-and-nobody-noticed>

- Cohen, J. (2008). Principles and interest: Is the academy an accomplice in a corporate-caused pandemic? In J. Turk (Ed.), *Universities at risk: How politics, special interests and corporatization threaten academic integrity* (pp. 24-42). Toronto: James Lorimer and Company.
- Council of Canadian Academies. (2012). *The state of science and technology in Canada, 2012*. Ottawa: Council of Canadian Academies.
- Crespo, M., and Dridi, H. (2007). Intensification of university-industry relationships and its impact on academic research. *Higher Education, 54* (1), 61-84.
- Elliot, C. (2010). *White coat black hat: Adventures on the dark side of medicine*. Boston: Beacon Press.
- Fagin, D., and Lavell, M. (1996). *Toxic deception*. New Jersey: Carol Publishing Group.
- Fanelli, D. (2009). How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. *PLoS ONE, 4*(5), e5738.
- Ferguson, C. (2010). Larry Summers and the subversion of economics. *Chronicle of Higher Education*.
- Ferrie, H. (2013). *Creative outrage*. Caledon, Ontario: KOS Publishing.
- Ferrie, H. (2009, June). Deadly side-effects of prescription drugs spark lawsuits. Ottawa: Canadian Centre for Policy Alternatives Monitor.
- Fine, P. (2009, August 30). Professor admits to ghost-written paper. *University World News, 90*.
- Freudenburg, W. (2005). Seeding science, courting conclusions: Reexamining the intersection of science, corporate cash, and the law. *Sociological Forum, 20* (1), 3-33.
- Friedberg, M., Saffran B., Stinson, T., Nelson, W., and Bennett, C. (1999). Evaluation of conflict of interest in economic analysis of new drugs used in oncology. *Journal of the American Medical Association, 282*(15), 1453-1457.
- Gutstein, D. (2009). *Not a conspiracy theory: How business propaganda hijacks democracy*. Toronto: Key Porter Books.
- Healy, D. (2012). *Pharmageddon*. Los Angeles: University of California Press.
- Healy, D. (2008). Academic stalking and brand fascism. In J. Turk (Ed.), *Universities at risk: How politics, special interests and corporatization threaten academic integrity* (pp. 108-137). Toronto: James Lorimer and Company.
- Healy, D., and Cattell, D. (2003). The interface between authorship, industry and science in the domain of therapeutics. *British Journal of Psychiatry, 182*, 22-27.
- Holden, C. (2006). Professional practice: Scientists keep some data to themselves. *Science, 311*(5760), 448.

- Kaufman, P., Cohen, J., Ashley, Mary Jane., Ferrence, R., Halyk, A., Turcotte, F., Kyle, K., and Stewart, D. (2004). Tobacco industry links to faculties of medicine in Canada. *Canadian Journal of Public Health*, 95(3), 205-208.
- King, R. (1999, February 2). Medical journals rarely disclose researchers' ties, drawing ire. *The Wall Street Journal*.
- Kirsch, I. (2010). *The emperor's new drugs: Exploding the antidepressant myth*. New York: Basic Books.
- Krimsky, S. (2008). When sponsored research fails the admissions test: A normative framework. In J. Turk (Ed.), *Universities at risk: How politics, special interests and corporatization threaten academic integrity* (pp. 70-94). Toronto: James Lorimer and Company.
- Krimsky, S. (2003). *Science in the private interest: Has the lure of profits corrupted biomedical research?* New York: Rowman and Littlefield.
- Krimsky S., Rothenberg, L.S., Stott, P., and Kyle, G. (1996). Financial interests of authors in scientific journals: A pilot study of 14 publications. *Science and Engineering Ethics*, 2(3), 395-410.
- Lacasse, J., and Leo, J. (2010). Ghostwriting at elite academic medical centers in the United States. *PLoS Medicine*, 7 (2), e1000230.
- Lazaridis, M. (2004, November 9). The importance of basic research. Retrieved from <http://cou.on.ca/news/commentary---events/commentary/commentary-pdfs/the-importance-of-basic-research-mike-lazaridis-no>
- Lea, R. (2010). BP, corporate randd, and the university. *Academe*, 96 (6).
- Lesser, L., Ebbeling, C., Goozner, M., Wypij, D., and Ludwig, D. (2007). Relationship between funding source and conclusion among nutrition-related scientific articles. *PLoS Medicine*, 4(1), e5.
- Lexchin, J. (2010, April 19). Ontario's big pharma drug war. *The Bullet*, 342. Retrieved from <http://www.socialistproject.ca/bullet/342.php>
- Lexchin, J., Bero, L., Djulbegovic, B., and Clark, O. (2003). Pharmaceutical industry sponsorship and research outcome and quality: systematic review. *British Medical Journal*, 326, 1167-1170.
- Mangan, K. (2007, October 26). Medical schools see many ties to industry. *Chronicle of Higher Education*.
- McMurtry, J. (2009, July/August). The corporate administration vs. the vocation of learning. Ottawa: Canadian Centre for Policy Alternatives Monitor.
- Merton, R. (1973). *The sociology of science*. Chicago: University of Chicago Press.
- Mirowski, P., and Van Horn, R. (2005). The contract research organization and the commercialization of scientific research. *Social Studies of Science*, 35 (4), 503-548.

- Murray, F., and Stern, S. (2007). Do formal intellectual property rights hinder the free flow of scientific knowledge? An empirical test of the anti-commons hypothesis. *Journal of Economic Behaviour and Organization*, 63, 648-687.
- Avoid financial 'correctness.' (1997). *Nature*, 385(6616), 469.
- Nestle, M. (2007). *Food politics: How the food industry influences nutrition and health*. Los Angeles: University of California Press.
- Neuman, J., Korenstein, D., Ross, J., and Keyhani, S. (2011). Prevalence of financial conflicts of interest among panel members producing clinical practice guidelines in Canada and United States: Cross sectional study." *BMJ*, 343(7827).
- Olivieri, N. 2000. When money and truth collide. In J. Turk (Ed.), *The corporate campus: Commercialization and the dangers to Canada's colleges and universities* (pp. 53-62). Toronto: James Lorimer and Company.
- Polanyi, M. (1969). *Knowing and being*. Chicago: University of Chicago Press.
- Polster, C. (2007). The nature and implications of the growing importance of research grants to Canadian Universities and academics. *Higher Education*, 53(5), 599-622.
- Polster, C. (2000). The future of the liberal university in the era of the global knowledge grab. *Higher Education*, 39(1), 19-41.
- Ridgeway, J. (2010, June 28). Drug pushers in academia. *Mother Jones*. Retrieved from <http://www.motherjones.com/mojo/2010/06/big-pharma-continuing-medical-education>
- Rosell, C., and Agrawal, A. (2009). Have university knowledge flows narrowed? Evidence from patent data. *Research Policy*, 38(1), 1-13.
- Rothman, D., McDonald, W., Berkowitz, C., Chimonas, S., DeAngelis, C., Hale, R., Nissen, R., Osborn, J., Scully, J., Thomson, G., and David Wofsy. (2009). Professional medical associations and their relationships with industry: A proposal for controlling conflict of interest. *Journal of the American Medical Association*, 301(13), 1367-1372.
- Schafer, A. (2008). The university as corporate handmaiden: Who're ya gonna trust? In J. Turk (Ed.), *Universities at risk: How politics, special interests and corporatization threaten academic integrity* (pp. 43-69). Toronto: James Lorimer and Company.
- Schafer, A. (2004). Biomedical conflicts of interest: A defence of the sequestration thesis – learning from the cases of Nancy Olivieri and David Healy. *Journal of Medical Ethics*, 30(1), 8-24.
- Schmidt, J. (2000). *Disciplined minds: A critical look at salaried professionals and the soul-battering system that shapes their lives*. Lanham, Maryland: Rowman and Littlefield.

- Schrecker, E. (2010). *The lost soul of higher education: Corporatization, the assault on academic freedom, and the end of the American university*. New York: The New Press.
- Sharav, V. (2014). Peer-reviewed research to support drug approval often false. *Health Impact News*. Retrieved from <http://healthimpactnews.com/2012/peer-reviewed-research-support-drug-approval-often-false/>
- Sismondo, S. (2009a, May). Medical publishing and the drug industry: Is medical science for sale? *Academic Matters*.
- Sismondo, S. 2009b. Ghosts in the machine: Publication planning in the medical sciences. *Social Studies of Science*, 39(2), 171-198.
- Sismondo, S. (2008). Pharmaceutical company funding and its consequences: A qualitative systematic review. *Contemporary Clinical Trials*, 29, 109-113.
- Sismondo, S. (2007). Ghost management: How much of the medical literature is shaped behind the scenes by the pharmaceutical industry?" *PLoS Medicine*, 4(9), e286.
- Slaughter, S., and Gary Rhoades. (2004). *Academic capitalism in the new economy: Markets, state and higher education*. Baltimore: Johns Hopkins University Press.
- Smith, R. (2005). Medical journals are an extension of the marketing arm of pharmaceutical companies. *PLoS Medicine*, 2 (5), e138.
- Snider, L. (2003). Researching corporate crime. In S. Tombs and D. Whyte (Eds.), *Unmasking the crimes of the powerful: Scrutinizing states and corporations*. New York: Peter Lang.
- Snider, L. (2000). The sociology of corporate crime: An obituary. *Theoretical Criminology*, 4(2), 169-206.
- Starfield, B. (2000). Is US health really the best in the world? *Journal of the American Medical Association*, 284(4), 483-485.
- Stelfox, H., Chua, G., O'Rourke, K., and Allan Detsky. (1998). Conflict of interest in the debate over calcium-channel antagonists. *New England Journal of Medicine*, 338(2), 101-106.
- Sumner, J. (2008). Keeping the commons in academic culture: protecting the knowledge commons from the enclosure of the knowledge economy. In A. Chan and D. Fisher (Eds.), *The exchange university: Corporatization of academic culture* (pp. 188-202). Vancouver: UBC Press.
- Tamburri, R. (2012, June 6). Full-time Canadian faculty report high job satisfaction. *University Affairs*.
- Thompson, J. (2008). Academic integrity and the public interest. In J. Turk (Ed.), *Universities at risk: How politics, special interests and corporatization threaten academic integrity* (pp. 306-348). Toronto: James Lorimer and Company.

- Universities Allied for Essential Medicines. (2013). University global health impact report card. Retrieved from <http://globalhealthgrades.org/about/>
- Washburn, J. (2005). *University Inc.: The corporate corruption of American higher education*. New York: Basic Books.
- Whitaker, R. (2010). *Anatomy of an epidemic: Magic bullets, psychiatric drugs, and the astonishing rise of mental illness in America*. New York: Crown Publishers.
- Willinsky, J., Murray, S., Kendall, C., and Palepu, A. (2007). Doing medical journals differently: *open medicine*, open access, and academic freedom. *Canadian Journal of Communication*, 32, 595-612.
- Wilson, D. (2010, November 29). Drug maker hired writing company for doctor' book, documents say. *The New York Times*.
- Wolff, R. (1969). *The ideal of the university*. Boston: Beacon Press.
- Woodhouse, H. (2009). *Selling out: Academic freedom and the corporate market*. Montreal: McGill-Queen's University Press.