4 The Ethical and Legal Foundations of Scientific 'Conflict of Interest'

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'Conflict of interest' is embedded in many areas of public ethics. Certain enactments named for their ethical content, such as the U.S. *Ethics in Government Act*, have sections devoted to 'conflict of interest,' and the legal community, government officials, financial organizations, and many news organizations have strict guidelines on such conflict. Yet the term is rather new to the scientific and medical research communities. Prior to 1980 little public attention was given to scientists with competing interests in their research. The first medical journal to introduce a conflict of interest disclosure requirement was the *New England Journal of Medicine* in 1984, followed a year later by the *Journal of the American Medical Association.*[1]

One might ask whether conflicts of interest among scientists should be treated differently than they are in other professions. Why, moreover, did the concern about conflicts of interest arise so much later among scientists, compared to public policy and law? This chapter explores the ethical and legal foundations of conflict of interest (COI) in the sciences and asks whether COI among scientists, in contrast to other professions, represents an ethical problem.

Science and Ethics

Conflict of interest in science and medicine has been defined as a set of conditions in which professional judgment concerning a primary interest (i.e., integrity of research) tends to be adversely influenced by a secondary interest (i.e., financial gain).[2] There are two possible explanations for why the issue of conflict of interest arose late among the scientific professions: (1) scientists were believed to operate within a

normative system that mitigates any concerns about such conflict, and (2) considerable public trust afforded to scientists, including clinical investigators, eclipsed any potential societal concerns about competing interests.

Science is a self-governing system, subdivided into professional societies, journals, and communication networks, referred to as the 'invisible colleges' that define the shared areas of study, outlets of publication, and collaboration of similarly trained individuals.[3] Its normative structure, emphasizing the importance of scepticism, replication, and empirical verifiability, according to some observers, makes any other interests scientists may have irrelevant to the mission of science. Only one set of interests can lead to success within the profession – the unfettered commitment to methodological rigour and the pursuit of verifiable knowledge.

Throughout the nineteenth and much of the twentieth centuries, with the exception of Nazi science, which is generally viewed as an aberration, the ethics of science was uniquely tied to its epistemology, insulating it from public oversight. It was not until the 1970s that the bubble of normative insularity of science was burst, specifically for clinical trials and human experiments generally. Scientists using human subjects are in a fundamental conflict of interest that is inherent to the process. As researcher, the primary concern of the scientist is to determine the truth about the effectiveness and efficacy of a treatment. The focus has to be on the observance of sound methodology, honest data gathering, and statistical rigour. If too many subjects are dropped from a trial, the results may not be publishable in the most competitive journals.

As a clinician, however, the researcher has a responsibility (as expressed by the Hippocratic Oath) to do no harm and to try to help a sick patient get better. In their effort to balance these goals, clinical researchers sometimes fail to disclose all the risks facing the subject, or fail to stop the trial for a subject who is having adverse reactions. Alternatively, they may make a premature leap from animal studies to human trials in their enthusiasm to reach a positive outcome for a drug before their competitors do. In the wake of highly publicized cases where the concerns of human subjects were discounted in favour of a researcher's professional interests, legislation or regulation emanating from funding agencies focusing on the protection of human subjects was adopted in the United States, Canada, and other countries with advanced centres of biomedical research.

The long tradition of trust in science was rooted in the myth of the scientist as a selfless investigator of universal truths. As scientists

proved their utility to civilization in the eighteenth and nineteenth centuries, some philosophers and scientists alike began to think of science as also providing insights into the moral order of the universe – an idea with roots in Greek philosophy. As J.H. Randall noted in his classic work, *The Making of the Modern Mind*, 'The Order of Nature contained an order of natural moral law as well, to be discovered and followed like any other rational principles of the Newtonian worldmachine.'[4] Philosophers of science who believed that there was a parallel between the formal structure of science and that of ethics proposed a theory of ethics based upon a deductive nomological system comparable to mathematical physics.[5] The aspiration of developing a system of ethics derived from natural law or modelled on the mathematical sciences met its demise concurrently with the refutation of logical positivism as the foundation of philosophy.

Another view held by some sociologists of science and natural scientists writing *qua* humanists is that the culture of science has its own ethical system, which serves as a model for other sectors of society. Jacob Bronowski popularized the view that 'science has humanized our values,'[6] while Robert Merton introduced the normative structure of the social system of scientific organizations, which he observed in the early twentieth century.[7]

The conditions under which scientists and government officials, including judges, carry out their fiduciary responsibilities may be quite different. In addition, the normative constraints on science and government and the lines of accountability are distinct. Conflicts of interest in science and government are not necessarily rooted in a similar ethical matrix or based on a comparable legal foundation. In fact, one might justifiably question whether COI in science can be grounded in *any* ethical matrix. The discourse over COI in science might just be about political correctness. We can, however, object to conflicts of interest in science and medicine on grounds other than ethical ones. If there *is* an ethical basis for addressing conflicts of interest among academic scientists, we need to consider the ethical principle (or principles) on which it rests. I shall begin this inquiry by asking the following questions: What factors establish COI as an ethical concern in public affairs? Do those factors apply to scientific COI? If not, do other considerations apply to scientists?

COI in Government

Government employees are stewards of the public's policies, its land, laws, and regulations. Federal officials who use their positions to gain

personal financial benefit are in conflict with their fiduciary role as stewards of public resources. In this sense they are trustees of the public's properties, regulations, and its legal traditions. COI *behaviour* (financially self-serving decision making) is a violation of the ethical principle that government employees should not use their positions for personal gain. Generally, we cannot know whether a decision of a public official was made out of self-interest or whether that self-interest and public interest happen to coincide. Why not regulate or punish *only* the behaviour that violates the ethical principle?

Andrew Stark, in his book *Conflict of Interest in American Public Life*, provides a three-stage anatomy of conflict of interest.[8] The *antecedent acts* (stage 1) are factors that condition the state of mind of an individual towards partiality, thereby compromising the potential of that individual from exercising his or her responsibility to foster public rather than private or personal interests. Examples are government employees accepting gifts, paid dinners, and the like. The *states of mind* (stage 2) represents the affected sentiments, dispositions, proclivities, or affinities conditioned by the antecedent acts. Thus, a politician who accepts a substantial campaign contribution from an individual may be more inclined to favour that individual's special business needs in legislative decisions than if no contribution were given.

The final stage represents the outcome behaviour or *behaviour of partiality* (stage 3) of the public official or those actions taken by that individual (decision behaviour) arising from a state of mind affected by the antecedent acts. The outcome behaviour could result in self-aggrandizement or in rewarding friends at the expense of the general public interest.

If public conflict-of-interest law were directed only at stage 3, the behaviour of partiality, this would have several implications. First, a person could be found guilty of conflict of interest only if it could be proved that his or her behaviour resulted from gifts, favours, or mutually self-serving relationships. We cannot infer the disposition or intention of the public employee from the outcome of a policy or regulatory decision. It is difficult to characterize a person's state of mind. Consider the case where a U.S. president issued a pardon to a person living outside the United States who was charged with a felony and who never stood trial. Funds contributed to the president's campaign can be traced to the alleged felon's immediate family. How would one show that there is a link between the gifts, the President's state of mind, and the decision to issue a pardon?

The third implication of focusing exclusively on outcome behaviour in COI law is that it would have little prophylactic effect. Most of the damage is already done by the time the legal processes kick off. Only a small number of cases would be prosecuted, since the burden of demonstrating violations would be high.

As Stark notes, 'because we cannot prevent officials from mentally taking notice of their own interests, we prohibit the act of holding certain kinds of interests in the first place.'[9] Therefore, the law operates on the public health model of 'primary prevention.' Public employees are required to be free of any conditions that may dispose them to act in a way that elevates self-interest (particularly financial self-interest) over public interest.

In public health 'primary prevention' means eliminating the exposure. In COI terminology, 'primary prevention' means 'avoiding the appearance of conflict of interest.' The best of our journalists operate on a preventative principle by not accepting lunch, gifts, or drinks from a person they interview. The ethical principle may be stated as follows: To protect the public's confidence in a free and independent press, journalists must comport themselves in such a way that avoids even the appearance that they could gain a financial benefit from the slant or context of a story or the way in which they present an individual.

Does the stewardship frame apply to scientists? In fact, scientists do have some stewardship functions. A great majority of the grants scientists receive in academic research are from public funds. Scientists are obligated to use the funds according to the provisions of the grant. They are expected to publish the results of their research in the open literature. If an American scientist makes a commercially useful discovery from his/her publicly funded grant, then under the *Bayh-Dole Act* (1980), the U.S. government transfers all intellectual property rights to the discovery to the researcher and his/her institution. This is a case where public investment is turned into private wealth, indicating a limited stewardship role of the scientist over the grant income.

The stewardship frame does not fit well with the self-image of university scientists, who place a high premium on academic freedom and independence. It is also not consistent with federal policies, which have created incentives for faculty to partner with for-profit companies and to start their own businesses. In other words, the U.S. government provides incentives for academic scientists to hold conflicts of interest. The government has reconciled these tensions by requiring disclosure and COI management of federal grant recipients at their institutions.

Another reason the U.S. government does not embrace the stewardship frame for COIs is that it would place a high burden on federal agencies for waiving a COI. Moreover, because the university is the legal recipient of the federal grant, it would have to address institutional conflicts of interest, a decision that the U.S. government has deferred.

Under the 1972 *Federal Advisory Committee Act* (FACA), agency advisory committees are explicitly forbidden to be inappropriately influenced by special interests, and its members must comply with federal conflict of interest laws designed to protect the government process from 'actual or apparent conflicts of interest.'

Two rules guide the U.S. federal advisory committee structure on conflicts of interest.[10] The first states that no person with a substantial conflict of interest can serve on a federal advisory committee. A federal employee may not 'participat[e] personally and substantially in an official capacity in any particular matter in which, to his knowledge, he or any other person ... has a financial interest if the particular matter will have a direct and predictable effect on that interest.'[11] However, the second rule holds that the first rule can be waived.

In a study of Food and Drug Administration (FDA) advisory committees covering more than a year and a half, *USA Today*'s investigative journalists found that there were 803 waivers for conflicts of interests in 1,620 member appearances, or about 50 per cent.[12]

Scientists are not stewards of public law or natural resources, certainly not in the way public employees or elected officials are. As recipients of public grants, it might be argued that academic scientists have stewardship of public funds and thus their relationship to those funds must be clear of conflicts of interest. This is not a popular argument, and it was not used to justify the Guidelines on Conflict of Interest issued by the National Science Foundation and the Public Health Service. The title of the Public Health Service Guidelines on conflict of interest is 'Objectivity in Research.'[13] Thus, managing COIs among scientists was viewed as promoting scientific integrity, not protecting public law, regulations, or property from being compromised by personal interests.

Disclosure of Interests

While 'stewardship ethics' does not seem applicable to academic science, another ethical response to scientific COI, one which has gained

moderate acceptance in recent years, is transparency. The argument for scientists to disclose their conflicts of interest might be framed as follows. Scientists are expected to abide by the canons of their discipline even as they hold other interests, such as financial interests, in the subject matter of their research. The disclosure of one's financial interests (patents, equity holdings, honoraria) is deemed a responsibility because it allows peer reviewers, editors, and readers to look at published studies with additional scepticism.

Organized scepticism, one of the four Mertonian norms,[14] plays a central part in the scientific culture. A good scientific paper will discuss possible methodological limitations of a study and sources of bias. In many fields, it is considered the responsibility of the author to invoke a self-referential scepticism. Disclosure of one's financial interest in the subject matter of a paper falls into that tradition of barring all reasonable biases.

An author's financial disclosure might suggest to reviewers or readers that they consider how hidden biases related to the revealed interest might have entered the study. Also, disclosure allows editors to decide whether the conflicts are so egregious that the paper should not be published in their journal.

Disclosure also provides another social value. When an author's commercial affiliations are not cited in the publication of a paper but are learned after a controversy erupts, it makes it appear that the scientist has something to hide, even if he/she does not. In other words, with the lack of transparency of affiliation, public trust in science is diminished.[15]

Is disclosure a sufficient ethical response to scientific COI? Disclosures considered under COI policies or guidelines when scientists submit a paper for publication, testify before Congress, are recipients of a federal grant, or serve in an advisory capacity include whether the scientist:

- is a stockholder in a company that may benefit from research, a review, or an editorial;
- is a paid expert witness in litigation;
- receives honoraria from companies;
- is a patent holder;
- is a principal in a company that funds his/her research;
- serves as a paid member of a scientific advisory board or board of directors of a company.

The application to clinical trials of the informed consent ethical framework has recently come under debate. There are two streams of thinking here. One view is that COI is inherently unethical in clinical trials because it breaks the trust relationship between patient and physician. The second view holds that COI is not inherently unethical but must be part of the well-established informed consent process. Thus far, informed consent has focused on the nature of the medical intervention, including risks and benefits to the subject. Introducing COI into the informed consent process is viewed by some as a marked departure from the ethics of patient care.

In the case of the tragic death of Jesse Gelsinger in September 1999, the young man was not fully advised of the conflicts of interest involved in his experimental gene therapy treatment. During the investigations following Gelsinger's death, it was learned that the director of the University of Pennsylvania's Institute for Human Gene Therapy, James Wilson, founded a biotechnology company called Genovo, Inc. Both he and the University of Pennsylvania (Penn) had equity stakes in the company, which had invested in the genetically altered virus used in the gene therapy experiment. Wilson and one of his colleagues had also been awarded patents on certain aspects of the procedure. Genovo at the time contributed a fifth of the $25 million annual budget of Penn's gene therapy institute and in return had exclusive rights over any commercial products. The informed consent documents made no mention of the specific financial relationships involving the clinical investigator, the university, and the company. The eleven-page consent form Gelsinger signed had one sentence that stated that the investigators and the University of Pennsylvania had a financial interest in a successful outcome. When Genovo was sold to a larger company, James Wilson had stock options reported to be worth $13.5 million; the university's stock was valued at $1.4 million.[16] According to the report in the *Washington Post*, 'numerous internal U. Penn. documents reveal that university officials had extensive discussions about the possible dangers of such financial entanglements.'[17]

The Gelsinger family filed a wrongful death lawsuit against the university, which was eventually settled out of court for an undisclosed sum of money. One of the plaintiff's allegations in the suit was that the clinical investigator overseeing his trial had a conflict of interest that was not adequately disclosed prior to Jesse Gelsinger's involvement. They argued that the financial interests in conjunction with other undisclosed or downplayed risks might have altered the family's risk

benefit estimate before entering the trial and saved young Gelsinger's life. After Penn settled with the Gelsinger family, the university administration announced new restrictions on faculty involved in drug studies when they have equity in companies sponsoring the research.

In the aftermath of the Gelsinger case, the Department of Health and Human Services (DHHS), under the leadership of Secretary Donna Shalala, held hearings on whether the financial interests of clinical investigators should be listed on informed consent documents given to prospective candidates for clinical trials. In a draft guidance document DHHS suggested that researchers involved in clinical trials disclose any financial interests they have to Institutional Review Boards that monitor other ethical issues and possibly to the patients deciding whether to participate as human subjects. Leading scientific and medical associations, including the Federation of American Societies of Experimental Biology (FASEB) and the American Association of Medical Colleges (AAMC), opposed the idea of a guidance document for clinical trials, arguing that it over-regulates medical research without contributing to the safety of patients.

Millions of Americans participated in more than 40,000 clinical trials in 2002, about 4,000 of which were supported by the National Institutes of Health (NIH). Research scientists and the companies sponsoring those trials were concerned that the additional disclosure requirements with no direct bearing on the safety or benefits of the trials would create unnecessary impediments to attracting human volunteers. On the other hand, the decision to become a human volunteer in a medical experiment can be one of the most important choices a person can make. Why should a prospective volunteer not know everything of relevance to the trust relationship they are asked to develop with the clinical investigator?

Conflict of interest in clinical trials has become an ethical issue because of the perceived fiduciary responsibility of the clinical investigator to disclose all relevant information to the human subject. This legal responsibility was upheld by the California Supreme Court in the case of the MO-Cells, cells taken from John Moore during his surgery without his informed consent.[18]

Consequentialist Ethics of COI

Does anything intrinsically unethical occur when a scientist engages in research in which he or she has a commercial interest? To answer affir-

matively we would have to demonstrate that such a condition would violate the scientist's fiduciary responsibility to some person or persons, or that there is an inherent conflict between any of those relationships and the scientists' goal or mission *qua* scientist. With the exception of human subjects research, there is no compelling argument here. I can find no inherent reason why scientists cannot pursue the truth and still participate in the commercialization of that knowledge. The two activities do not appear to be logically or conceptually in conflict. But the context and consequences of scientific COI may be ethically significant. Does possessing a commercial interest in the subject matter of one's research have other, unintended effects?

In his book *Real Science*, John Ziman addresses the question of the significance of 'disinterestedness' in ensuring the objectivity of science.[19] He observes that in the current climate of commercial science, 'what cannot be denied is that the academic norm of disinterestedness no longer operates.'[20] While Ziman asserts that we can no longer assume 'disinterestedness' as a norm in this period of 'post-academic science,' 'the real question is whether their [scientists'] interests are so influential and systematic that they turn science into their unwitting tool.'[21] In other words, will the loss of 'disinterestedness' result in the demise of objectivity?

Ziman distinguishes between two concepts of objectivity. He defines cognitive objectivity as an epistemic concept that refers to the existence of physical entities and their properties and that is independent of what we may know about them. Cognitive objectivity is attained when we tap into the properties of the 'objective world,' that segment of the physical universe that exists independent of our thought processes.

Social objectivity is defined by Ziman as the perception that the knowledge process is not biased by the personal self-interest of the knower. Despite the loss of 'disinterestedness' in science, Ziman believes that cognitive objectivity can be protected. 'The production of objective knowledge thus depends less on genuine personal "disinterestedness" than on the effective operation of other norms, especially the norms of communalism, universalism and scepticism. So long as post-academic science abides by these norms, its long term cognitive objectivity is not in serious doubt.'[22]

I dwell on Ziman's work because he provides an important context for understanding society's ethical and legal response to scientific COI. Cognitive objectivity is the verifiable and dependable knowledge science seeks. If that knowledge is not threatened by the loss of disinter-

estedness, then society's response to COI may be decidedly different than if it were. And while social objectivity (the public's perception of objectivity) may be important, its loss does not, in itself, affect the quality of certifiable knowledge – the published research in our peer-reviewed journals.

How can we determine whether cognitive objectivity is preserved in post-academic science? In contrast to other methods of fixing belief, science is considered to be self-correcting. It is generally understood that, in the long run, systematic bias and errors in science will eventually be disclosed and corrected. However, the time period for self-corrections in science to take place can be quite protracted. It took about 1800 years before Galileo corrected Aristotle's laws of motion. While errors or bias in modern science may not have to wait that long to be discovered, they can be very damaging even for short periods. Witness the work of Sir Cyril Burt on twin studies and IQ: Burt's results influenced cognitive psychologists and educational theorists for decades before it was discovered to be a fraud.[23] The faith we have in the self-corrective nature of science must be viewed against the effects of biased studies in fields like biomedicine, toxicology and material science. Within this context we may ask whether multi-vested science is distorted by a conflict of interest effect. In Ziman's words, will the loss of disinterestedness affect cognitive objectivity? A relatively new body of research can help us answer this question.

In the consequentialist framework, the ethics of COI is viewed in terms of whether holding a conflicting interest correlates with one of the transgressions in science. The burden is to demonstrate a link between possessing a COI and some level of scientific misconduct or bias. The generally accepted transgressions in science include the following:

- scientific fraud;
- failure to give informed consent;
- wanton endangerment of human or animal subjects;
- plagiarism; and
- systematic bias.

Borderline ethical issues include:

- unwillingness to share scientific data/information; and
- participation in ghost writing.

A COI can be said to be an ethical issue in science if it disposes a scientist to commit an ethical transgression – that is, if it increases the probability that the scientist will violate his/her professional responsibility. If COI does not affect the professional responsibility of scientists, then perhaps efforts taken towards managing COI have, as suggested above, more to do with political correctness than with righting an ethical wrong.

In 1996 Les Rothenberg and I published a study which showed that lead authors of articles published in fourteen highly rated journals had a 34 per cent likelihood of having a financial interest in the subject matter of the publication. *Nature Magazine* wrote an editorial stating that:

> It comes at no surprise to find ... that about one third of a group of life scientists working in the biotechnology rich state of Massachusetts had financial interests in work they published in academic journals in 1992. The work published makes no claim 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.[24]

Five years later, *Nature* reversed itself and decided it would introduce conflict of interest requirements for authors.[25] In its editorial announcing the change of policy *Nature* wrote, 'there is suggestive evidence in the literature that publication practice in biomedical research has been influenced by the commercial interests of authors.'[26]

What do we know about the relationship between possessing a financial interest and bias? Is there a funding effect in science? If there is evidence that the private funding of science produces conclusions biased towards the interests of the sponsor, then we have a genuine cause for treating COI as an ethical problem. The first set of systematic studies that looked at whether there was an association between the source of funding and the outcome of a study was centred on the drug industry.

One of the most elegant and influential studies demonstrating an association between funding source and outcome was published in 1998 in the *New England Journal of Medicine* by a Canadian research team at the University of Toronto.[27]

This study began with the question of whether there was an association between authors' published positions on the safety of certain

drugs and their financial relationships with the pharmaceutical industry. The authors focused their study on a class of drugs called calcium channel antagonists, which are used to treat hypertension. Their choice was based on the fact that the medical community debated the safety of these drugs. The researchers performed a natural experiment to investigate whether the existing divisions among researchers over the drug's safety could be accounted for by funding sources, whether, that is, medical researchers were financially connected to the pharmaceutical industry, and whether those affiliations explained their conclusions.

First, the authors identified medical journal articles on calcium channel blockers (CCBs, also known as channel antagonists) published between 10 March 1995 and 30 September 1996. Each article (and its author) was classified as being supportive, neutral, or critical with respect to these drugs. Second, the authors were sent questionnaires which queried whether they had received funding in the past five years from companies that manufacture either CCBs or products that compete with them. The investigators ended up with seventy articles (five reports of original research, thirty-two review articles, and thirty-three letters to the editor). From the seventy articles, eighty-nine authors were assigned a classification (supportive, neutral, or critical). Completed questionnaires about author financial interests were received from sixty-nine authors. The study results showed that an overwhelming number of the supportive authors (96 per cent) had financial relationships with manufacturers of CCBs, while only 37 per cent of the critical authors and 60 per cent of the neutral authors had such relationships. The authors of the *New England Journal of Medicine* study wrote that 'our results demonstrate a strong association between authors' published positions on the safety of calcium-channel antagonists and their financial relationships with pharmaceutical manufacturers.'[28]

Other studies confirm a funding effect for randomized drug trials,[29] economic analyses of new drugs used in oncology,[30] and research on nicotine's effect on human cognitive performance.[31]

Marcia Angell, former editor of the *New England Journal of Medicine*, commented that it was her impression that 'papers submitted by authors with financial conflicts of interest were far more likely to be biased in both design and interpretation.'[32] Angell's impression was validated by findings that appeared in the *Journal of the American Association* from a meta-type analysis on the 'extent, impact, and man-

agement of financial conflicts of interest in biomedical research.'[33] Beginning with a screening of 1,664 original research articles, the authors culled 144 that were potentially eligible for their analysis and ended up with 37 studies that met their criteria. One of the questions the authors pursued in their study was whether there was a funding effect in biomedical research. Eleven of the studies they reviewed found that industry-sponsored research yielded pro-industry outcomes. The authors concluded:

> Although only 37 articles met [our] inclusion criteria, evidence suggests that the financial ties that intertwine industry, investigators, and academic institutions can influence the research process. Strong and consistent evidence shows that industry-sponsored research tends to draw pro-industry conclusions. By combining data from articles examining 1140 studies, we found that industry-sponsored studies were significantly more likely to reach conclusions that were favourable to the sponsor than were nonindustry studies.[34]

There are perhaps a dozen or so studies that confirm the funding effect in science for clinical drug trials. The effect has also been confirmed for tobacco research[35] and postulated but not rigorously analysed for toxicological studies of industrial chemicals,[36] nutrition research,[37] and policy studies.[38] Notwithstanding these results, there is no evidence that COI is correlated with scientific fraud or other serious ethical violations. Moreover, it is difficult to assess how generalized or pervasive the funding effect is. To reach the conclusion that research studies authored by scientists with commercial interests in the subject matter is inherently unethical (on the basis of a few dozen selected studies) because of a potential funding effect is neither defensible nor practical. There is, after all, over $2 billion in private research and development (R&D) funding going to U.S. universities (about 7 per cent of the total R&D budget in academia). To make the case that privately funded research fails the objectivity test and therefore is unethical would require a vast study of studies in a variety of disciplines as well as replication of results.

A recent survey reported in the journal *Nature* of several thousand U.S. scientists begins to provide some of the answers. Early and mid-career scientists were asked to respond anonymously to sixteen questions on their research behaviour. One of the questions scientists were asked was whether they have changed the design, methodology, or

results of a study in response to pressure from a funding source; 20.6 per cent of the mid-career scientists and 9.5 per cent of the early-career scientists answered affirmatively.[39]

Several sectors, such as privately funded tobacco research, have been targeted as untrustworthy. As a consequence, some universities have refused to accept tobacco money for research or other purposes. In areas where the funding effect in science has not been confirmed, a consequentialist ethic for managing conflicts of interest (where assessing moral significance is predicated on their consequences to science) may not apply. There is, however, another ethical framework which has been incorporated into legal doctrine and applied to other sectors to prevent or minimize COI.

Integrity of Science as an Ethical Norm

Protecting the integrity of scientific enterprise is embedded in the scientific ethos. Organized scepticism, objectivity, disinterestedness, correcting mistakes, punishing scientific misconduct, peer review, and institutional review boards are all part of the system the scientific community has established to protect the integrity of the scientific enterprise. One can argue that a scientific discipline replete with conflicts of interest is likely to lose its integrity in the eyes of the general public because it appears to be accountable to interests other than the pursuit of truth. In Ziman's terms, even if science's cognitive objectivity is protected, the social objectivity of science will be threatened.

> In the eyes of the public, the major virtue of academic scientists and their institutions is that, even when they do disagree, they can be trusted to present what they know 'without fear or favour.' Whether or not this high level of credibility is really justified, it is what gives science its authority in society at large. Without it, not only would the scientific enterprise lose much of its public support: many of the established conventions of a pluralistic, democratic society would be seriously threatened.[40]

There is a quantity-quality relationship. As a field of science becomes increasingly commercialized, the quality of the science and the public's confidence in it suffers. Just think of cigarette science, or the studies funded by the lead or the chemical industry. The goal behind these industry-funded research agendas is to manufacture uncertainty for the purpose of derailing or postponing regulation. If the protection of

scientific integrity is a societal goal and conflict of interest is an obstacle to reaching that goal, then COI should be viewed as an ethical issue. Moreover, preventing or minimizing COI becomes an ethical imperative.

We try to prevent COI in legal procedures because it erodes the goal of a fair trial. Federal judges cannot own a single stock in a company that is a litigant in their courtroom. It would be inconceivable for society to accept a judge's declaration that, in deference to transparency, he would disclose that he was sentencing a convicted felon to serve his sentence in a for-profit prison in which he, the judge, has equity interests. The courts are exclusively funded by public sources; universities and professors receive funding from public and private sources. We cannot apply the same standards. But there are certain conditions where the integrity of research is so critical to public trust that a response is warranted.

What can be done to restore the integrity of academic science and medicine at a time when turning corporate and blurring the boundaries between non-profit and for-profit are in such favour? We should perhaps begin by harkening back to the principles on which universities are founded. We should consider the importance of protecting those principles from erosion and compromise for the sake of amassing larger institutional budgets and providing more earning potential for select faculty members. I have proposed several principles:

- the roles of those who produce knowledge in academia and those stakeholders who have a financial interest in that knowledge should be kept separate and distinct;
- the roles of those who have a fiduciary responsibility to care for patients while enlisting them as research subjects and those who have a financial stake in the specific pharmaceuticals, therapies, or other products, clinical trials, or facilities contributing to patient care should be kept separate and distinct; and
- the roles of those who assess therapies, drugs, toxic substances, or consumer products and those who have a financial stake in the success or failure of those products should be kept separate and distinct.[41]

The ethical foundations needed for protecting the integrity of science demand measures that go beyond the mere disclosure of interests.[42] If disclosure were the only solution, scientists would be viewed as sim-

ply other stakeholders in an arena of private interests vying for epistemological hegemony. The ethical principles – as ideals – would require that certain relationships in academia be prohibited. The legal foundations, however, remain uncertain. Currently, the law has little to offer on the question of preventing a clinical investigator from having a financial conflict of interest in therapies while caring for patients or supervising clinical trials. Universities have become the self-managers of COI both among their own faculty and for their own institution. There are no legal sanctions for transgressing a norm, because there are no established legal norms. In other areas of public ethics, the laws are more explicit. In the United States, the roles of financial auditors and accountants have been under more scrutiny since the Enron affair. New rules have separated auditing from other financial dealings. Legal separation of conflicting roles, however, has not reached the scientific community, perhaps because scientists, unlike lawyers, politicians, and accountants, are still viewed as adhering to a standard of virtue that renders them immune from compromise by their involvement with commercial interests. Recent scientific evidence reveals a quite different picture.

NOTES

1 Marcia Angell and Jerome P. Kassirer, 'Editorials and Conflicts of Interest,' Editorial (1996) 335 New Eng. J. Med. 1055; Catherine D. DeAngelis, Phil B. Fontanarosa, and Annette Flanagin, 'Reporting Financial Conflicts of Interest and Relationships between Investigators and Research Sponsors,' Editorial (2001) 286 J. Am. Med. Ass'n 89.

2 Dennis F. Thompson, 'Understanding Financial Conflicts of Interest' (1993) 329 New Eng. J. Med. 573.

3 Diana Crane, *Invisible Colleges: Diffusion of Knowledge in Scientific Communities* (Chicago: University of Chicago Press, 1972) at 35.

4 John Herman Randall, *The Making of the Modern Mind* (Boston: Houghton Mifflin, 1976).

5 Henry Margenau, *Ethics and Science* (Princeton, NJ: D. Van Nostrand, 1964)

8 Andrew Stark, *Conflict of Interest in American Public Life* (Cambridge, MA: Harvard University Press, 2000).
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