AUTONOMY, DISINTEREST, AND ENTREPRENEURIAL SCIENCE

Sheldon Krimsky

There is general agreement among a wide spectrum of informed observers that, beginning in the late 1970s and early 1980s, American research universities underwent changes that brought them greater commercialization. The changes involved:

- Greater emphasis on intellectual property
- Stronger ties between academia and the private sector, including research and development partnerships
- Greater emphasis on research over teaching and service
- Less concern about protecting traditional academic values such as free and open exchange of ideas, and sharing of biological materials such as cell lines
- More emphasis in new income streams whatever their source.
- Institutional involvement in business ventures, equity partnerships, and new faculty startup companies.

There is no consensus about the meaning of these changes. Are they simply an accentuation of trends that already existed? Do they represent changes in degree rather than in kind? Do they foreshadow a new ethos in science and/or a new breed of professoriate? Is there a change in the norms of "disinterestedness" and "autonomy" within academic science? Will closer ties between academia and business portend less independence for the university? Is this a permanent and irreversible change or can some traditional values be restored?

Several of these questions require a careful historical study of American research universities. Because the United States does not have a homogeneous system of universities, the effects are not being felt uniformly. The American Association of University Professors (AAUP) collects and organizes data based on a five-part classification system of universities. Category I comprises the elite universities that award doctoral degrees. To be classified a category I institution in the AAUP database, a university must grant a minimum of 30 doctoral-level degrees annually, awarded by three or more unrelated disciplines. Category II institutions either do not grant doctoral degrees or they grant too few to qualify as Category I. The lowest rung of the classification consists of two-year colleges whose faculty has no ranks. Between the first and second ranked schools (Categories I and II) the average full professor salaries differ by $25,000 (*Academe*, March/April 2005).

Out of 3,773 institutions AAUP surveyed in 2004-05, about 8 percent (299) were classified as Category I. However, Category I institutions have 48 percent of the total faculty in the entire system of universities: 176,000 out of 368,000. Moreover, the top 200 research institutions accounted for 95 percent of all the Research and Development (R&D) expenditures in 1997 (National Science Foundation, Science & Engineering Indicators, 2000). It is certainly true that universities aspire to become Category I because that is where the prestige lies, and where there are better salaries, lower teaching schedules, and more amenities.

In recent years, American universities have become more commercialized and more managerially (and therefore less democratically) administered. These observations are supported by indicators such as patents, a proxy measure of the commercial orientation of faculty, and reported declines in faculty governance. The number of patents obtained by universities has risen dramatically from 96 granted in 1965 to 3,200 in 2000. Similarly, private sector contributions to university R&D budgets have grown. There has also been a trend in university investment into faculty start-up companies and Offices of Technology Transfer on campuses.

University R&D funding from industry was 2.5 percent in 1966 and rose to about 4.1 percent in 1980, 6.1 percent in 1992, and then to 7.7 percent in 2000. According to the National Science Foundation's *Science and Technology Indicators*, "The funds provided for academic R&D by the industrial sector grew faster than funding from any other source during the past three decades although industrial support still accounts for one of the smallest shares of funding" (National Science Foundation 2000). Expressing the changing R&D budgets of universities on average does not tell the whole story. Averages can fluctuate and obfuscate what is occurring at any given institution. The number of universities whose industry contribution to its R&D funding exceeds twice the average or about 15 percent appears to be rising. In 2000, Duke University received 35 percent of its R&D budget from industry, followed by Georgia Tech with 24 percent, Penn State with 17 percent, and University of Texas with 15 percent. Smaller schools also followed the trend: Alfred University, University of Tulsa, Eastern Virginia Medical School, and Lehigh University had 48, 32, 24, and 22 percent, respectively, of industry contributions to their R&D budgets (D. Stein, *Buying In or Selling Out?* 2004).

Given the changes in university culture and funding, we may question whether the norms of *autonomy* and *disinterestedness* have changed among academic scientists. Before we can address these claims, we should not assume that the meanings of these terms are generally understood. If the autonomy of scientists has declined, then against what standard is it measured? And with respect to *disinterestedness*, what does that mean and how can we assess or interpret a change in it?

I shall address these questions by examining the concepts of *autonomy* and *disinterestedness* in relationship to science. I shall explore how and under what conditions these terms are relevant to scientific practice in the context of what some observers have referred to as the new era of academic capitalism.

Autonomy

Absolute autonomy in the university is a myth. It would involve a set of conditions that allow a scientist to investigate any problem he or she chooses, regardless of the cost, and without any external accountability—such as peer review or human subjects committees. This is not a functional view of autonomy. Surely, it is not reasonable to assume that a scientist has the right to pursue any investigation (other than pencil and paper operations that do not require external support) regardless of cost, ethical impact, merit, social values, or environmental consequences. But relative autonomy is not unrealistic and distinguishes university professors from scientists in other sectors. It operates within the constraints of peer review, the funding sources, human and animal subject requirements, and accountability to other legal and ethical norms.

Relative autonomy requires the following minimum conditions:

1. The investigator selects the subject matter of the study. A biologist trained in genetics can choose from an array of research programs from human to bacterial genetics, from analysis of existing life to synthesis of new life, or from clinical genetics to behavioral genetics. A frontier area of research—such as endocrine disruptors or epigenetics—might attract new investigators. The new area of research might be given primacy for federal funding, which signals the researcher to apply—but does not dictate it. Or a new technology like micro-arrays in genomics might also attract new users among scientists in the light of new grant opportunities. Although external funding opportunities play a large role in shaping what people decide to study, it is still their choice on how they want to frame a study, which grants to apply for, what methodology to use or, in the context of declining support, whether to switch areas of research or to stop doing sponsored works.

2. Methods and protocols developed to undertake the research are the choice of the investigator and not imposed on the investigator by a sponsor.

3. Data that comes from the investigation is controlled by the investigator and his/her research team and not by the funding source.

4. Interpretation of results is largely the responsibility of the investigative team and not subject to external control by a funding agency or sponsor.

5. Publication of the results is also controlled by the researchers involved in the study. Because of concerns that research sponsors impose covenants on scientists restricting publication of certain findings, the International Committee of Medical Journal Editors has issued guidelines to participating journals. Authors must sign an affidavit that they and not the sponsors are in control of the publication.

Autonomy in the university extends beyond the investigator's choice of research project, control of the methodology, ownership of data, and the right to interpret results. It also means the right of faculty to speak freely and independently on subjects of their expertise or for that matter on any subject that they choose. This is what we generally mean by academic freedom.

The legal concept of academic freedom has been traced back to Germany around 1850 when the Prussian Constitution asserted the freedom of scientific research (*Freiheit der Wissenschaft*). Harvard University, chartered in 1650, appointed Edward Wigglesworth its first professorship (of Divinity) in 1722 without limit of time, ushering in the tenure system into North America.

At the turn of the twentieth century, Edward A. Ross, Stanford University economist and secretary of the American Economics Association, spoke out in favor of municipal ownership of utilities and supported the socialist Eugene V. Debs for his presidential bid. Ross was fired from Stanford University in 1900 because of the influence of a member of the university Board of Trustees whose wealth was tied to the private ownership of utilities. Two philosophers, Arthur Lovejoy and John Dewey acted in response to this abuse of board power by establishing the American Association of University Professors (AAUP). AAUP first issued the doctrine on tenure in 1915. It changed the balance of power at American universities and established the idea that professors with tenure had a measure of autonomy, at least in principle, to speak freely and undertake research in areas of their choosing without controls placed on them by their institution—administrators or Board of Trustees—and without the fear that they could lose their position because of what they believed or wrote. The privilege of tenure, which included protected speech and employment, was adopted by most American universities by the mid-twentieth century as a result of the continued leadership and influence of the American Association of University Professors. Without job security and academic freedom, it can be argued, there would be no autonomy in the professoriate.

During the period of the 1950s, a number of universities fell prey to the cult of Senator Joseph McCarthy, who exploited the public's fears about the spread of communism. A number of faculty who were known to be Marxists or socialists or simply open-minded enough to discuss these ideas were fired for being a national security risk and, therefore, untrustworthy to hold academic positions.

Of course, tenure does not guarantee a fair wage, salary increases, or a good working environment. There remain many ways that outspoken faculty with minority views can be punished and ostracized. There is no absolute protection against academic tyranny, but job security and the protection of "academic freedom" of speech remain strong protection in universities that are not replicated widely in other sectors of society.

My own case illustrates the point. While a young untenured professor, I supervised a class research project where students investigated a controversy over the contamination of an aquifer in a small New England town. Under my direction, the students prepared a report on contested hydrogeology of contamination, the role of public agencies, and the behavior of a multinational corporation at the center of the controversy. Before the report was issued, a vice president of the company tried to block publication and dissemination of the students' study by lobbying the president of my university. The president had not seen the report and could not comment on its veracity. But he did understand the concept of academic freedom in the university. The quality of the report was my responsibility—not the president's nor the university. I could be sued but my university would not be held accountable in this case because it was not a party to a contract or grant.

When Robert Merton wrote about the autonomy of science it was in the context of the rise of fascism and the totalitarian state. He questioned how science, which is embedded in the social order, can remain independent from state ideology, while it is largely dependent on state resources? Merton saw a growing tension between the scientific and political cultures. "The conflict between the totalitarian state and the scientist derives in part, then, from an incompatibility between the ethic of science and the new political code which is imposed upon all, irrespective of occupational creed" (R. Merton, *Social Structure and Social Theory*, 1957, 541). Scientific autonomy means that scientists can operate according to their professionally derived norms rather than the dicta of state ideology. Currently, scientific autonomy is threatened by a president who introduces religious and political beliefs as a litmus test for responsible science (C. Mooney, *The Republican War Against Science*, 2005). "Science must not suffer itself to become the handmaiden of theology or economy or state. The function of this sentiment is likewise to preserve the autonomy of science" (Merton 1957, 543). In 1938, Merton addressed the autonomy of science, as an institution, when it faced threats by authoritarian state interests. He wrote, "the social stability of science can be ensured only if adequate defences are set up against changes imposed from outside the scientific fraternity itself" (R. K. Merton, "Science and the Social Order" *Philosophy of Science* 5 [July 1938]: 328).

Autonomy in science is more complex, however, than protection of the scientific subculture from a totalitarian state. To understand this we have to recognize that decline in autonomy may arise externally or internally. External causes of decline result from factors outside the control of the scientist, where power and authority are taken from him or her. As an example, suppose a scientist requires funding for research but can only get the funds from a sponsor who requires control over how the data shall be interpreted? Similarly, a scientist might give up control to the sponsor of designing a research protocol in exchange for receiving funding for the study.

An internal decline in autonomy results from the choices made by the individual scientist, who chooses to conform to a new social structure within the university. For example, scientists who start their own companies and continue as full-time professors will embody a new corporate persona. The norms and values of the corporate scientist are different from those of an academic scientist in as much as the latter will more likely feel freer to criticize products and activities that appear in conflict with the public interest. Once the norms of the commercial culture are superimposed onto the university, the autonomy of the academic scientist is destined to decline. Professors (like other workers) will eventually internalize the values of their institutions.

Also, a person who was hired at the university but who does not have the security of tenure, loses some autonomy—or the protection against dismissal resulting from his or her alignment with unpopular views including political and intellectual deviance. Autonomy, academic freedom, and the tenure system are interlocking and mutually reinforcing systems. It is possible to have the benefits of academic freedom and tenure but yet decide not to use either in the ways that a fully autonomous professor might. In other words, there is something we can call autonomous self-repression resulting from the adaptation of an academic to an emerging corporate culture that has colonized the university.

A faculty member who is also involved with a startup company is straddling two cultures, one that has a tradition of independence of thought and critical self-expression and the other that is premised on withholding public criticism that might malign the corporate name or create enemies in an industry that works out its differences though backroom negotiations and quiet litigation rather than public discourse.

Many scientists require research funding in order to do their work. Often, they will follow the fashions of the funding sources by necessity. There are some fields like philosophy, classical studies, mathematics, literature and the like that produce scholarship without much funding, if any at all. Because their choices are less constrained by funding opportunities, I would argue that they have more autonomy to select their areas of study than other scientists who must work within the constraints of sponsored research. Nevertheless, there is still an advantage to autonomy in university science over that of industry or government, particularly when sponsored research does not determine whether the individual has a job, in other words where "soft money" is survival. Many medical schools operate on a system where faculty may have tenure but must raise their own salary from sponsored research.

The case of Tyrone Hayes, an endocrinologist at the University of California at Berkeley shows what happens when funding imperatives meet the core values of an investigator. Hayes, who studied the effects of low concentrations of the herbicide atrazine on frogs, found that minute amounts of the chemical inhibit the development of the frog's larynx and feminize males. His research initially received funding from the private sector. When his sponsors learned that he was getting positive results they tried to delay publication because the studies were not in their financial interest. The contract he signed stated that the company retained the final say over what could be published. Hayes eventually disassociated from the company and reasserted his right to publish his findings (*Chronicle of Higher Education*, October 31, 2003).

There is no absolute autonomy in science. Those scientists who do not work in a hierarchical institution, who are not beholden to a single source of external funding, or possess no external funding at all, who have academic freedom and are not self-constrained or externally constrained from exercising it, whose livelihoods are not wholly dependent on external funding (soft money), who are not financially or professionally vulnerable to pressure for suppressing or distorting results or for remaining silent while others violate the ethical norms of science, score higher on the scale of autonomy, *ceteris parabus*, than those who cannot claim to be working under these condition.

Government scientists report greater constraints on their scientific autonomy than academic scientists. Those government scientists who speak freely end up either taking on the role of "whistle blower" or becoming marginalized by their federal agency.

University administrators also can exert pressure on scientists whom they view as a liability or embarrassment to the institution. For example, Theodore Postol, a professor of security studies at MIT issued a critique of the effectiveness of the Patriot missile system. His institution, MIT, had an interest in a positive evaluation of the missile shield since the developer of the Patriot missile, Raytheon, sponsored research at MIT. Because the university system has traditionally been non-hierarchical and protective of basic job security for its faculty, the opportunity still exists for professors to exercise a higher degree of autonomy even under the risk of marginalization and recriminations in salary and space by their institution (*Boston Globe Magazine*, October 23, 2005). It is testimony to the importance of *autonomy* that some academics embrace it—in the public interest—despite the penalties they incur.

In 1937, Robert Merton delivered a talk to the American Sociological Society Conference titled "Science and the Social Order," subsequently reprinted in the journal, *Philosophy of Science*, in which he stated: "The sentiments embodied in the ethos of science—characterized by such terms as intellectual honesty, integrity, organized skepticism, disinterestedness, impersonality—are outraged by the set of new sentiments which the State would impose in the sphere of scientific research" (Merton 1938, 327). As previously noted, Merton was responding largely to the growth of fascism and its challenge to the autonomy of science. He continued in his later writings to emphasize "disinterestedness" as a norm of scientific activity without defining it outright. His writings indicate that by "disinterestedness" he meant "of no concern for the utility of science" including any fame or fortune it can bring the scientist. Consider the following passage from his 1938 paper (p. 328). "One sentiment which is assimilated by the scientist from the very outset of his training pertains to the purity of science. Science must not suffer itself to become the handmaiden of theology or economy or state."

Disinterestedness

One of Merton's interpreters and colleagues Norman Storer wrote: "In Merton's original delineation of disinterestedness he relates it almost exclusively to prohibiting the scientist from making the search for professional recognition his explicit goal" (N. Storer, *The Social System of Science*, 1966, 79). The currency of science, according to Storer, can only be its contribution to knowledge, as an end in itself. Any other commodities consciously sought from the work such as fame or money would denigrate the integrity of the enterprise. He states that "the norm [disinterestedness] acts primarily to prohibit the scientist from planning his work so that he will personally benefit from it in terms of money, influence, public esteem, or even professional reputation" (Storer 1966, 102). Storer also includes in the norm of "disinterestedness" an emotional detachment from any theory or hypothesis in which the scientist may be investigating. Such an attachment can result in inflexibility and recalcitrance toward accepting negative results.

> Emotional neutrality, hand in hand with rationality and universalism, enjoin the Scientist to avoid so much emotional involvement in the work that he cannot adopt a new approach or reject an old answer, when his findings suggest that this is necessary, or that he unintentionally distorts his findings in order to support a particular hypothesis. (Storer 1966, 80)

Notwithstanding these rather idealized views of the emotionally detached and disinterested scientist, there is the popular image of the multi-vested scientist who holds many competing personal, professional, institutional, and fiduciary interests. How do we reconcile the norm of "disinterestedness" with the new profile of the entrepreneurial scientist? Let me proceed with a typology of interests held by contemporary academic scientists:

1. Predilection (intellectual, ideological and/or emotional attachment) to a hypothesis or theory.
2. Applied applications of inquiry.
3. Patent or intellectual property derived from a research discovery.
4. Financial interests in the sponsor of the research beyond funding.
5. Propensity toward and interest in a positive outcome (for publication).
6. Academic promotion.
7. Securing a grant.
8. Implications of the science on public policy.
9. Ethical significance of the science.
10. Professional standing among scientific peer group.
11. Equity interest in a company with a commercial interest in one's work.
12. Paid consultant in one's area of expertise.

Some have argued that these interests are indistinguishable with respect to their potential influencing effects on a scientist's judgment and therefore emphasizing financial interests is a form of political correctness (K. Rothman, *Journal of the American Medical Association* 269: 2782, 1993). However, the popular culture, professional organizations, legislators, and scientific/medical journals have selected "financial interests" as a special category. The requirement of transparency of any real or perceived financial conflicts of interest speaks to the special consideration placed on monetary relationships between scientists and other parties related to the subject matter of their research. But is it justified?

Distinguishing Financial Conflicts of Interest

It is true that all scientists have multiple interests in their work, whether financial or otherwise. But is there a rational basis for distinguishing a scientist's financial interest from other interests such as seeking fame or promotion or desiring a positive outcome from a study to maximize the chance of publication?

The argument that all interests are fungible and that financial interests cannot and should not justifiably be set apart for ethical considerations is disingenuous on several counts. First, our legal and regulatory institutions have long distinguished financial interests from other types of relationships and interests. The Ethics in Government Act, for example, places special emphasis on government employees who have financial interests associated with their public responsibilities in policy or regulatory matters. Section 208(a) in the rule issued by the Office of Government Ethics prohibits employees of the executive branch from participating in an official capacity in matters in which they, or persons or entities in which they have a relationship, have financial interests. Senior government officials must set aside their stock holdings in a blind trust, but they are not required to set aside their friendships or disqualify themselves from votes because of friendships or campaign support. Judges, on the other hand, are expected to recuse themselves in cases where they have a financial interest or personal association. The judiciary has a higher ethical standard than other federal and state government employees.

Second, some interests cannot be disassociated from the scientific enterprise. For example, the desire for fame, professional advancement, or to win the race to scientific discovery are inextricably part of the enterprise of science. While it is plausible that such interests can bias the outcome of one's scientific work, they cannot be distilled from the practice of science. The Korean stem cell scientist Hwang Woo Suk appeared to be on the path to international fame as the first scientist allegedly to clone a dog and human embryonic stem cells. The drive for international honor and prestige, both for Dr. Suk and his country, blinded him to the standards of honesty and integrity in science. In an investigation of his claims, Seoul National University administrators charged Dr. Suk with fabricating scientific data. He subsequently resigned from his institution admitting to having submitted false data in a major publication (*New York Times*, December 21, 2005, A1).

Third, a scientist's predilection for a certain theory or hypothesis is generally part of his or her published record. Nothing is hidden about a scientist's preferred approach toward understanding or explaining physical phenomenon. One scientist may accept the linear dose-response relationship for chemicals at very low doses, while another might support the threshold hypothesis. Because the correct hypothesis cannot currently be decided empirically, it is understood by the scientific community that a preference for one hypothesis over another can influence the interpretation of data. In another example, scientists are beginning to question the somatic mutation theory of cancer (cancer begins from a mutated cell) and in its place have proposed a field theory of cancer etiology whereby neoplasms arise from the interaction between bodily cells and tissues. No one doubts that a scientist's association with one theory or hypothesis over a competitor will shape his or her interpretation of experimental evidence.

We expect scientists to become passionate about their theories. It is part of the social and psychological enterprise of science that scientists advocate for a preferred explanatory framework. The eminent twentieth-century philosopher of science Karl Popper believed that scientists should seek to falsify their theories because theory verification, unlike theory falsification, was logically impossible. He wrote:

> ...what characterizes the empirical method is its manner of exposing to falsification, in every conceivable way, the system to be tested. Its aim is not to save the lives of untenable systems but, on the contrary, to select the one which is by comparison the fittest, by exposing them all to the fiercest struggle for survival. (K. Popper, *Logic of Scientific Discovery*, 1959, 42)

While it is true that most scientists do not seek to falsify their hypotheses, the norm of organized skepticism obligates the scientific community to subject a theory or hypothesis to the most rigorous examination possible to determine if it stands up against the evidence at least as well as other explanations.

Thus, it can be argued that it is part of the enterprise of science that scientists align themselves with one or another explanatory framework. These interests have become part of their intellectual legacy, which is open to public view in their scholarly writings. Any bias associated with a scientist's propensity toward one theory or another can be discussed and addressed in open communication with the scientific community.

In contrast, a scientist's financial interest in the subject matter of his or her research is typically not in the public record and cannot be helpful in judging epistemological bias. In other words, financial bias is outside the discourse of rational debate. It should also be recognized that good science can be produced without financial interests in the outcome of research, but cannot be done without a scientist's epistemological and psychological interests in the outcome.

If one were to examine the effect of conflicts of interests on the bias of research, it would be possible to design a study that investigated whether financial interests were more heavily weighted toward one outcome over another. A group of such studies was conducted in drug research and the reports will be summarized in this article. Investigators divided published papers into two groups. One group consisted of authors who were funded by government or nonprofit organizations. In another group of matched studies authors received their funding from for-profit companies. Using selected outcomes such as potential risks associated with the drug or efficacy comparing new versus old versions of a drug, the investigators were able to determine whether financial interests correlated with interests of the for-profit sponsor.

Such studies can be undertaken because "holding a financial interest" or "receiving funding from a for-profit sponsor" is a contingent part of any study, and thus can be compared to a control group where these relationships do not appear. The same is not true about having a passion for one's hypothesis or seeking recognition for one's work. All scientists share these interests and as a result their influences are ubiquitous, mitigating the possibility of a controlled study for ascertaining the effects of such interests.

For the above reasons, the financial interest of scientists as a source of potential bias remains an area of concern among journal editors, members of the print media (where conflict of interest among journalists is a serious matter), medical societies, and government ethics committees.

Funding Effect and Objectivity

Beginning around the mid-1980s, medical sociologists and biomedical ethicists began to study whether corporate-funded research was more biased toward the sponsor as compared to similar research funded by nonprofit institutions or government agencies. Within a decade, a body of work had evolved that confirmed the "funding effect" in studies on the safety and efficacy of drugs. Some examples follow. One report found that authors with financial interests in drug studies were 10-20 times less likely to present negative findings compared to those without such interests (L. S. Friedman and E. D. Richter, *Journal of General Internal Medicine* 19 [2004]: 54). In another study, the author reported that "in no case was a therapeutic agent manufactured by the sponsoring company found to be inferior to an alternative product manufactured by another company" (R. A. Davidson, *Journal of General Internal Medicine* 1 [1986]: 155). A third study design took the form of a meta-analysis where the authors reviewed numerous published papers to determine whether the source of funding had an effect on the outcome. The investigators began by screening 1,664 original research articles. These were culled to 144 that were potentially eligible for their analysis. They ended up with 37 studies that met their criteria and found 11 that showed industry-sponsored research confirmed a funding effect:

> 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. (J. E. Bekelman et al. *Journal of American Medical Association* 289 [January 22/29, 2003]: 463)

The fact that "possessing a financial interest" in one's research has a biasing effect is a troubling finding for science. Simply disclosing the effect does not minimize or bring to light the particular bias. The funding effect raises the question of whether scientists who hold such interests can be "disinterested," whether as a norm "disinterestedness" is linked to objectivity, and whether "financial conflict of interest" is a good predictor of bias.

The distinguished British physicist John Ziman, who contributed important scholarship to the sociology of science, tackled these issues in his book *Real Science*. He observed that science was undergoing a transformation from its traditional role in universities pursuing basic research to a new variant he called post-academic science. According to Ziman, "post-academic scientists are expected to be continually conscious of the potential applications of their work" (J. Ziman, *Real Science*, 2000, 74). Moreover, he believes that the norm of disinterestedness no longer applies in most contemporary science. "What cannot be denied is that the academic norm of disinterestedness no longer operates.... Even the genteel pages of the official scientific literature...are being bypassed by the self-promoting press releases" (Ziman, 2000, 162).

However, Ziman does not view the loss of disinterestedness as epistemologically connected to the demise of objectivity. Rather, he argues, objectivity can be preserved in post-academic science even with the loss of disinterestedness. An individual scientist's interests will be sorted out, selected, and adjusted for bias by the community of scientists who will operate with the other critical norms including organized skepticism (rigorously critiquing every result and testing it for its validity); communalism (sharing information); and universalism (operating under a shared set of criteria and scientific methodology). Ziman writes:

> The production of objective knowledge thus depends less on genuine personal "distinterestedness" than on the effective operation of the other norms, especially the norms of communalism, universalism and skepticism. So long as post-academic science abides by these norms its long term cognitive objectivity is not in serious doubt...but provided that organized skepticism continues to be practiced conscientiously, we need not revise our belief—or otherwise—in the "objective reality" of the scientific world view. (Ziman, 2000, 159)

What becomes lost in the age of post-academic science is short-term "social objectivity" or what Ziman describes as the public's trust in science. Ziman trusts the self-correcting power of science as evidenced by cases of scientific misconduct that come to light even after generations. This is why, I believe, Ziman considers that the loss of social trust in science will be restored once science corrects itself. But not all published knowledge is rechecked. Few experiments are or even can be replicated. It could take many years before mistakes are corrected or fraud, misconduct, and bias are discovered. During this period there can be damage to human lives, particularly in drug research. Manufactured tobacco science is such an example. If the funding effect proves to be pervasive, then it tells us that conflicts of interest distort objectivity. Whether the biasing effect will be discovered and how long it will take is another question. But should we build a system of scientific integrity on the hope that we can in due time reverse the distortions of biased, commercially vested science rather than *disinterestedness* serving as the norm?

Future of Autonomy and Disinterestedness

Both concepts make sense when applied to universities and independent research centers. The term "autonomy" describes the scientist's total control over his or her research from planning and executing a study to the interpretation and publication of results. The tendency of some observers to give up disinterestedness as a norm fails to distinguish financial interests external to the practice and epistemology of science from those interests that cannot be distilled from scientific work. They also neglect to fully acknowledge the pervasiveness of the funding effect in science and its implications for objectivity. Moreover, scientific pluralis.n—a marketplace of stakeholder interests—is not a substitute for protecting the (financial) disinterestedness of academic science. Transformation to a new stage of science that is blended seamlessly into commerce is neither desirable nor inevitable. Craig Calhoun's contribution provides an excellent overview and diagnosis of the problem, but I take issue with his comment that "it is important to realize there is no easy return to some earlier, better version of the university." The pendulum in academia has swung out of balance on more than one occasion—two examples being the McCarthy period and the Vietnam War. Subsequently, most universities reinstituted their traditional values of academic freedom and unclassified research. Efforts are currently underway to protect academia from egregious commercialization and we may yet see the pendulum return to a place where external influences, such as Big Pharma and tobacco money, do not distort research policy and damage scientific integrity. Universities and independent research institutes are beginning to understand the importance of reestablishing public trust in science while rewarding autonomy and disinterestedness.

FURTHER READINGS

Aronowitz, Stanley. 2000. *The Knowledge Factory*. Boston: Beacon Press.

Bok, Derek. 2003. *Universities in the Marketplace*. Princeton, NJ: Princeton University Press.

Greenberg, Daniel G. 2001. *Science, Money and Politics*. Chicago: University of Chicago Press.

Kassirer, Jerome P. 2004. *On the Take*. New York: Oxford University Press.

Rodwin, Marc. 1993. *Medicine, Money & Morals: Physicians' Conflicts of Interest*. New York: Oxford University Press.

Slaughter, Sheila, and Leslie, Larry L. 1997. *Academic Capitalism: Politics, Policies and the Entrepreneurial University*. Baltimore: Johns Hopkins University Press.

Stein, Donald D., ed. 2004. *Buying In or Selling Out? The Commercialization of the American Research University*. New Brunswick, NJ: Rutgers University Press.

Weisbrod, Burton A., ed. 1998. *To Profit or Not To Profit: The Commercial Transformation of the Nonprofit Sector*. Cambridge: Cambridge University Press.

Sheldon Krimsky is professor of urban and environmental policy and planning at Tufts University and adjunct professor in the Department of Public Health and Family Medicine at the Tufts School of Medicine. He is author of Science in the Private Interest *(2003).*