

Book Reviews

Fraud in Science

Betrayers of the Truth. WILLIAM BROAD and NICHOLAS WADE. Simon and Schuster, New York, 1983. 256 pp. \$14.95.

We are hearing a great deal these days about fraud in science. Since 1974, when Summerlin's partly black mice were found to owe their color to a felt-tipped pen, there have been several well-publicized instances of fraudulent research. Does this mean that there is more fraud, or is it simply that more attention is being focused on the subject?

I think both explanations are partly correct. There have always been instances of fraud in scientific research, prompted by such motivations as the desire for recognition, rivalry with another researcher, or a fanatical attachment to a theory. Now, however, there are new temptations. Before World War II, scientific research was engaged in by a relatively small number of devotees who generally had other means of earning a living, often teaching or, in the case of physicians, clinical practice. Now that the government has undertaken the major support of scientific research and the enterprise has grown enormously there are large numbers of individuals for whom research is an essential means of livelihood. Their advancement within their institutions and their claim on further government support are functions of their productivity. Since it is difficult and time-consuming to measure and agree on the quality of a scientist's output, a career is now evaluated in large part by the number of publications, with some adjustments made for the prestige of the journals in which they appear. No wonder that some career researchers are greatly tempted to cut corners in order to produce an acceptable manuscript. This is the new incentive to commit fraud; even without it, of course, the likelihood that fraud will occur has increased by virtue of the increased numbers of researchers.

At the same time that large-scale government funding of scientific research

has attracted careerists to science, it has also led to greater public attention to fraud when it occurs. After all, since the public is paying for science, it has an interest in knowing how its money is spent. The media respond to the proprietary interest of the public and also to its appetites. Fraud is a sensational story, and scientific fraud has the added dramatic element of a fall from grace of privileged members of society whose stock in trade is truth. For the media the irony is compelling.

So it is that William Broad and Nicholas Wade have entitled their book on fraud in science *Betrayers of the Truth*. This is a short, excited book that chronicles selected episodes of cheating in science—from Ptolemy to Darsee—and offers them as support for three theses: (i) that fraud is common in science, and always has been; (ii) that the faith of scientists in their own methods makes them especially vulnerable to fraud; and (iii) that the response of the scientific community to instances of fraud has been inexcusably feeble. The nucleus of the book consists of the accounts of several recent instances of fraud in science, all occurring within the last decade. Five of these (the cases of Alsabti, Long, Soman, Spector, and Darsee) have already been reported in considerable detail by Broad or by Wade, mainly in *Science*. All five researchers were trying to succeed in a system that demands a constant and high rate of publication and they cheated to do it. The invitation to fraud inherent in the relentless pressure to publish is clear to Broad and Wade, and they also see the dangers in the "research mills" that in part grow out of this pressure—the large laboratories, headed by a senior researcher who attracts the grant money but grows increasingly remote from the actual work.

The stories of the recent cases of fraud occupy about half of *Betrayers of the Truth*. The remainder of the book consists of extravagant ruminations on the nature of science and an effort to give the subject historical sweep by recounting

episodes of fraud in science from earliest times. All of this is offered in support of the contentions that fraud in science is frequent and that it somehow grows out of the very nature of science.

When Broad and Wade leave off reporting and attempt this sort of analysis, they lose their way. Much of this material is superficial and pointless, and some of it is, I think, simply wrong. If Ptolemy, Galileo, and Newton were cheats, what are we to make of that? It certainly tells us nothing about the frequency of fraud in science. The point of these sketchy anecdotes, then, is not always clear, and where it is, it is often forced, in large part because there is no allowance for the fact that the accepted purposes and methods of science change with time. The Lysenko case is put to a particularly eccentric use, not to document the pitfalls of pursuing science in a risky and unpredictable political climate but to demonstrate "the limits to the ability of the scientific method to resist encroachment by nonscientific ideologies." This predisposition of science to intellectual corruption is a recurrent theme in the book. According to Broad and Wade, scientists' belief in their own objectivity and immunity from "rhetoric and propaganda" has the paradoxical effect of making them "the more susceptible" to these forms of argument and "strangely vulnerable to the unexpected." It is not clear whether Broad and Wade mean that scientists more easily fall into fraudulent practices or are unusually slow to recognize fraud in others, or both, but it sounds ominous, if murky. I will have more to say about this later.

How frequent is fraud in science? After considering the scanty evidence on the subject Broad and Wade conclude, "We would expect that for every case of major fraud that comes to light, a hundred or so go undetected. For each major fraud, perhaps a thousand minor fakes are perpetrated." No basis for these numbers is given. This sort of calculation by expectation is surprising in such stern critics of scientists' estimates on the subject. It remains true, however, that the view held by some in the scientific community that fraud is in general not serious because it is rare and self-correcting is too sanguine. The truth is that no one knows whether fraud is rare or not or whether it will inevitably be found out. Though fraud with major scientific implications will probably be exposed by the scientific process in the long run (as in the Piltdown man hoax), this is not necessarily true of all fraud and certainly does not apply to the short run. Moreover, even rare instances of fraud dam-

age the trust essential to the integrity of science.

What of the second thesis of Broad and Wade, that the conceit of scientists somehow renders them especially vulnerable to fraud? The weakest portions of the book are those designed to support this argument. Much here hangs on the authors' contention that scientists adhere to a myth of logic: "Researchers are imbued in their lengthy training with the notion that science is a realm of thought where logic and objectivity reign supreme." I don't think so. This is a straw man, meant to imply that scientists are unrealistic, hence easily deceived. In real life, scientists are nowhere near so breathless about their work. Instead, they are by and large very much aware of the temptation to go beyond the evidence and most of them resist it. In this regard it is curious that Broad and Wade imply that there was something reprehensible in the reluctance of scientists to embrace the theory of continental drift, despite its "intuitive plausibility," until there was "incontrovertible evidence of the sort that compelled even the blind to see." It is disconcerting to find a critical attitude toward the attachment of scientists to evidence in a book devoted to suggesting that they are too easily swayed by rhetoric and propaganda.

Perhaps the most serious error in the depiction of science in *Betrayers of the Truth* is the implication that scientists do not take into account the possibility of self-deception. This is not so. Much of the thrust of modern scientific methods is directed at this problem. As examples, the randomized controlled trial, the heavy reliance on statistical analysis, and indeed the very format of scientific reports are designed in large part to deal with the possibility of self-deception. Yet Broad and Wade represent the conventions of the scientific report—"as stylized as a sonnet"—as a sort of public relations trick "so as to give the appearance of objectivity." They favor a much freer form, one that would permit the scientist to describe "the excitement of discovery, the false leads, the hopes and disappointments, or even the path of thinking that may have led him through the various steps of his experiment." This idea conveys little understanding of the purpose of the scientific report. One reason for the impersonal format is, as Broad and Wade should know, to require the researcher to confront his or her data. In short, it is to reduce the potential for obfuscation, bias, and, I would add, tedium that would be introduced by an account of the author's agonies and ecstasies.

Broad and Wade are on their surest ground in arguing their third thesis, that the responses of the scientific community to the recent cases of fraud were inadequate. The responses varied somewhat, but in general were marked by confusion and a horror of "going public." They were also slow. In the Soman case, no attempt was made to evaluate the extent of Soman's fraud until a year after he was known to be guilty of plagiarism and accused of having fabricated data. Even where institutions and individuals dealt with fraud swiftly, they did so quietly, with the aim of removing the guilty researcher from the particular institution. There was little sense of urgency in notifying journals to which the guilty researcher had submitted manuscripts, other collaborators who might not know of the fraud, and other institutions where the investigator had worked earlier. It was almost as though the concern was more with avoiding the taint of fraud than with preventing its propagation in the scientific literature.

Broad and Wade are correct, then, in seeing the responses as inadequate. Their tone of outrage, however, is inappropriate and does not allow for the complexities and uncertainties of dealing with a situation as it unfolds, rather than in hindsight. Much of the disorganization and delay simply reflected the fact that the scientific community had never developed mechanisms for dealing with fraud. Without established procedures, individuals who are faced with the possibility of fraud in their midst are subject to a number of concerns that make it difficult to act. These include uncertainties about due process and the legal ramifications of making an accusation of fraud, as well as the desire to protect the reputation and funding of the laboratory and the institution. Furthermore, the recent cases were handled not only on an ad hoc basis but usually by people close to the guilty researcher and to the work, who were therefore subject to bias.

Because of these problems, several academic medical centers, including Harvard and Yale, have recently moved to establish uniform guidelines for dealing with accusations of fraud and assessing guilt. The Association of American Medical Colleges appointed an Ad Hoc Committee on the Maintenance of High Ethical Standards in the Conduct of Research, which issued its guidelines last year. Such efforts are important and necessary steps. We also need to examine systematically ways to modify the incentives to publish, so that the emphasis on quantity is reduced.

It would be a pity if the scientific

community allowed the misconceptions in a book such as *Betrayers of the Truth* to deflect it from the important point that we must take fraud seriously and continue our efforts to develop mechanisms for dealing with it effectively.

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Ecological Interdependences

Ant-Plant Interactions in Australia. RALF C. BUCKLEY, Ed. Junk, The Hague, 1982 (U.S. distributor, Kluwer Boston, Hingham, Mass.). x, 162 pp., illus. \$54.50. Geobotany 4.

Mutualism between ants and higher plants is a fascinating subject of coevolutionary study for myrmecologists as well as botanists. The subject can be approached from the point of plant or ant adaptation or both and includes interactions such as ant predation on seeds and leaves and mutualisms involving ant-epiphytes, extrafloral nectaries, and myrmecochory (ant dispersal of seeds). The principal theme of *Ant-Plant Interactions in Australia* is the impact of ants on plants through seed predation and seed dispersal and the role plant species play as distributional determinants and limiting resources for ants. How tightly coupled are these interactions? What are the ecological variables that have led to the evolution of ant-plant interdependence? These questions are chiefly considered within the framework of population structure and dynamics.

Much attention (seven of 11 chapters) is paid to ant-seed interactions, which are indeed significant in Australia: roughly one-third of all plant species of the dry sclerophyll flora are myrmecochores. Of particular importance and interest is the book's treatment of the relatively unknown ant fauna in arid and semiarid areas of Western Australia and their relationships with plants. The individual contributions, however, are somewhat uneven in terms of scope, breadth of discussion and implications of results, and quantitative substantiation of hypotheses. The reader at times requires more information than is given to evaluate points raised. The narrative could be tighter in some papers. A few figures are difficult to comprehend owing to a lack of information in the text or legends. Occasionally I noted a confusion of terminology or an inaccuracy, particularly in regard to ant literature.

The papers either report on specific new findings or combine reviews of prior