CURRENT SCIENCE

Volume 68 Number 10 25 May 1995

EDITORIAL

Misconduct in science

Misconduct in science has been the subject of much recent debate, particularly in the United States. The enormous publicity attached to the Baltimore–Imanishi Kari and Gallo cases was largely due to the extraordinarily high profile of some of the researchers involved. The participation of congressional committees and even the Secret Service in the Imanishi Kari case lent a touch of the ludicrous to an otherwise unpleasant episode. The Himalayan geology scandal at the Punjab University, Chandigarh, has been extensively highlighted in the journal *Nature*. The decisions of the academic bodies involved have been pilloried in strongly worded editorials. Plagiarism has been the central charge in a widely publicized case involving members of the faculty of Hong Kong University; an imbroglio which promises to be resolved only in a court of law (*Nature*, 1994, **374**, 301). The recent report of 'doctored asymmetric synthesis' in magnetic fields (*Angew Chem. Int. Ed. Engl.*, 1994, **33**, 1457) suggests that scientific judgement can often crumble before the temptations of instant fame and glory – a feature so vividly demonstrated by the cold fusion fiasco. Lest readers get the impression that lowered ethical standards are a modern phenomenon, we review in this issue a recent book that attempts to debunk Louis Pasteur, one of the great scientific icons of our times.

A common feature of the misconduct cases is that in the final analysis alleged perpetrators, whistle-blowers, ostensibly impartial investigators and institutions charged with the responsibility of upholding scientific integrity, all end up with blackened faces. The fact that misconduct investigations reveal many unpleasant facets of the practice of science and dispel common (and unjustified) myths about science as an exclusive pursuit of truth and its practitioners being as pure as the driven snow, does much to make the average scientist deny that transgressions are common.

Scientific misconduct cases are rarely pursued and publicized in India. Even the Gupta case in Chandigarh was more widely discussed abroad than in the pages of our journals. A recent plagiarism case at the University of Poona and a similar happening on the pages of this journal (*Curr. Sci.*, 1994, **67**, 396–397) have prompted a newspaper to level charges against a senior physicist at the Tata Institute of Fundamental Research. In this issue, both the accusations and the response are printed – an action which we hope will set the record straight and end uninformed speculation that often damages all concerned. At first glance, the charges made do not appear too serious – a thesis supervisor using pages from a student's thesis, verbatim, in an invited review article without due acknowledgement. However, when looked at closely, the issues of authorship and credit-sharing emerge, both of which are central to the conduct of collaborative research. Much of modern science is the result of interactions between large numbers of individual researchers. Apportioning of credit is thus a sensitive and, sometimes, contentious matter. The attendant problems span an entire spectrum, ranging from overly restrictive authorship to cases of 'honorary authors', who most often occupy administrative positions, without participating in the planning, execution, interpretation or presentation of research. In the case of thesis supervisors and students, the relationship is often a privileged one, much like that between husband and wife. Almost every active academic will have a tale to recount, where the doctoral thesis of a student was largely the result of the supervisor's scientific and literary efforts. Fortunately, there will be just as many (if not more) examples where students with minimal guidance have produced marvellously scholarly dissertations. These, in a sense, are the salt of the earth. We have to evolve procedures by which they are recognized and encouraged, for they may be made of the stuff that will truly advance our science. Scientific misconduct can range from selective presentation of experimental data to support pet hypotheses ('there are none so blind as those who will not see'), unethical behaviour on the part of referees, editors and colleagues, plagiarism to outright fraud. Detection is often difficult and delayed, but the overwhelming strength of science is that none of this alters dramatically the course of its progress. Indeed, Joshua Lederberg argues that 'sloppy research extracts a greater toll than misconduct' (*Scientist*, Feb. 20, 1995, p. 13). Should misconduct be punished? Who will act as jury and who will be the judges passing sentence? Academic institutions have a special responsibility to see that minor transgressions lead to at least a 'mild rap on the knuckles' and that major misdemeanours are not brushed under the carpet. The reluctance to disturb apparent tranquility is sometimes mistaken as a licence to behave unethically. At the same time, self-righteous crusades, which most often cause greater damage to the innocent than to the guilty must be avoided. Witch hunts do not become modern science. Journals and editors have, of course, a special responsibility to ensure that the pages of their publications do not become a vehicle for carrying out scientific and personal vendettas. Also, we must not forget that the unwritten codes of conduct are only infrequently violated in

science and that cases of outright fraud are rare. This can hardly be said of many other professions. We must have confidence in ourselves and our colleagues. Peter Medawar said it best when he noted the importance of 'confidence as a bonding agent in the advance of civilization as it is indeed throughout professional life. Do not, lawyers, bankers, clergymen, librarians and editors, tend to believe their fellow professionals unless they have very good reason to do otherwise? Scientists are the same. The critical scrutiny of all scientific findings – perhaps especially of one's own – is an unqualified desideratum of scientific progress. Without it science would surely flounder – though not more rapidly perhaps than it would if the great collaborative expertise of science were to be subjected to an atmosphere of wary and suspicious disbelief'.

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CORRESPONDENCE

A report in the Economic Times (13 December 1994) made a charge that an article that was published in this journal in 1983 had sections identical to portions of a Ph D thesis and raised the issue of plagiarism. This charge has been repeated by a member of this journal's current Editorial Board (see below). The letter also cites the publication of a note regarding a case of alleged plagiarism in the 10 September 1994 issue. The present case is more complex, since the article under consideration was an invited review and the author the research supervisor of the student involved The material had been published elsewhere jointly, by the two individuals The absence of due acknowledgement to the source of the material and verbatim reproduction of paragraphs from the thesis may not constitute a major, intentional offence and could be construed, at worst, as a lapse of judgement. However, in view of the adverse publicity associated with the issue, and in an attempt to end the controversy, we publish below a set of letters which will hopefully clarify the situation. The letters written by S. K. Dhar and R. Vijayaraghavan were in response to letters from the Editors, eliciting their reactions. We shall not entertain further correspondence on this specific case.

– Editors

Plagiarism?

1. *Current Science* published a paper in 1983 by R. Vijayaraghavan of TIFR titled 'Magnetic behaviour of RRh_3B_2 ternary borides' (1983, **52**, 518–527). Late last year, there appeared in the press a substantiated story to the effect that this paper was plagiarized from the Ph D thesis of a (then) student of Vijayaraghavan, without so much as even an acknowledgement of the student's work.

2. I have since obtained a copy of the relevant portions (Chapter II) of the thesis of the (then) student, S. K. Dhar. I am attaching these portions with this letter. It is evident that major contents of the Vijayaraghavan paper published in *Current Science* are a straight lift from the thesis of S. K. Dhar; portions are verbatim reproductions. You will be able to confirm for yourself the unacknowledged concordance between the Vijayaraghavan paper and the Dhar thesis.

3. I believe that this amounts to plagiarism. Should you concur with my assessment, you could ask: What can be done now, twelve years after the offending paper appeared in *Current Science*?

4. I suggest that everytime it is alleged on the basis of credible evidence that a paper published in *Current Science* is plagiarized, *Current Science* should proceed along the correct line of action you have taken with the Aslam paper (*Curr. Sci.*, 1994, **67**, 396–397) and publish a notice prominently in *Current Science* about the plagiarism event.

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Responses

This is in response to your letter dated 14 March 1995. The paper under discussion appeared in *Curr Sci.*, 1983, **52**, 518–527. I was abroad working as a postdoctoral fellow at the Ames Laboratory, Iowa State University, USA, from 1 January 1983 to 31 December 1984. I had left around mid-December 1982 and returned to TIFR in January 1985. I was not aware of the above-mentioned paper until recently when it became public knowledge due to an article that appeared in the press.

The work reported in my thesis was done under the guidance of Prof. S. K. Malik and Prof. R. Vijayaraghavan (my Ph D registration at Bombay University was only with the latter). Most of the experimental work pertaining to my thesis work and the data analysis was done by me at TIFR. Low-temperature (in the liquid helium temperature range) magnetization measurements on some samples, on which the magnetization data down to liquid nitrogen temperature had initially been taken by me at TIFR, were carried out at the University of Pittsburgh, USA. At that time our group did not have proper facility to measure the magnetization in the liquid helium range. The initial drafts of most of the published papers were written by me. Several papers were published from the research work pertaining to my thesis. In all these papers both my supervisors were co-authors. The composition and the write-up of my thesis was entirely my own effort.

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You have asked me to give my views regarding the controversy about the paper 'Magnetic behaviour of RRH_3B_2 ternary borides' published in *Curr. Sci.*, 1983, **52**, 518–527. Since it is nearly 12 years since the publication of the paper,

I may not be able to recall all the details.

I was asked by the Editor to contribute an article for *Current Science*. Similar invitations seem to have been sent to other scientists as well. I notice that a good number of articles, in Vols 51 and 52 (1982, 1983), published in this category are in the nature of reviews, mostly by a single author. Regular research articles featuring new results seem to appear under the headings 'The Articles' and 'Short Communications'. Basically, my paper was an invited review article, covering substantially the results published in scientific journals along with my colleagues as co-authors and the results from other workers referred to in the article (for example, 1. Rhodes *et al.*, *Proc Roy. Soc.*, 1963, **273**, 247; 2. Ku *et al.*, *Solid State Commun.*, 1980, **35**, 91). One scientist who is intimately connected with this work from the beginning and made important contributions is my colleague Prof. S. K. Malik. My student Dr. S. K. Dhar's thesis was completed in 1982, and while the Ph D work was going on, we also wrote a few papers (listed below) for publication based on the work. At the end of the review article, I had expressed my gratitude to my colleagues of the Solid State Physics group (which includes my student) for the help, and to Prof W. E. Wallace of the Chemistry Department, University of Pittsburgh, USA, where some of the measurements on the magnetic properties of rare-earth rhodium borides, reported in the article, were made. As the *Current Science* article contains the salient information featured in the following papers, it is possible that the text of a chapter of the unpublished thesis was not changed in the review article.

1 Dhar, S K, Malik, S K and Vijayaraghavan, R (Tata Institute of Fundamental Research, Bombay 400 005, India), Strong itinerant magnetism in ternary boride $CeRh_3B_2$, *J Phys C Solid State Phys*, 1981, **14**, 321

2 Dhar, S K, Nagarajan, R, Malik, S K and Vijayaraghavan, R (Tata Institute of Fundamental Research, Bombay 400 005, India), Valence state of europium and magnetic ordering in $EuRh_3B_2$ – ^{151}Eu Mossbauer study, *Proc INSA*, New Delhi, 1982, p 792 Special volume on International Conference on the Applications of the Mossbauer effect, 14–18 Dec 1981

3 Malik, S K, Dhar, S K and Vijayaraghavan, R (Tata Institute of Fundamental Research, Bombay 400 005, India), Magnetic and NMR investigation of RRH_3B_2 (R = La to Gd) compounds, *J Appl. Phys.*, 1982, **53**, 8074

4 Malik*, S K, Vijayaraghavan*, R, Blotich, E B, Wallace, W E (Department of Chemistry, University of Pittsburgh, Pittsburgh, PA 15260, USA), and Dhar, S K (Tata Institute of Fundamental Research, Bombay 400 005, India), Itinerant magnetic ordering in $EuRh_3B_2$, *Solid State Commun*, 1982, **43**, 461

5 Malik*, S K, Vijayaraghavan*, R, Wallace, W E (Department of Chemistry, University of Pittsburgh, Pittsburgh, PA 15260, USA), and Dhar, S K (Tata Institute of Fundamental Research, Bombay 400 005, India), *J Magn Magn. Mat*, 1983, **37**, 303

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Also, my colleagues Dr S. K. Dhar and Prof. S. K. Malik continued to work on this system using other techniques around the same time and published the following two papers:

1 Devare, S H, Dhar, S K, Malik, S K and Devare, H G, Quadropole interaction . in RRh_3B_2 compounds, *Hyp Int*, 1983, **15/16**, 705

2 Hakimi, M, Hubner, J G, Delong, L E, Malik, S K and Dhar, S K, Temperature dependence of electrical resistivity of itinerant ferromagnetic $CeRh_3B_2$, *J Less Comm Metals*, 1983, **94**, 153

During my long research career of over 40 years, many colleagues who had obtained their Ph D degrees working with me have grown as distinguished members of the condensed-matter physics group. Dr. S. K. Dhar is one of them and we continue to work together.

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Indian science slows down

References 1 and 2 published macro-level scientometric indicators showing national performances in publication output for the eighties. Indicators for the first half (1980–1984) and the second half (1985–1989) were determined separately so that relative change could be measured. These indicators were compiled from the Science Citation Index (SCI) database. Five major fields were identified: life sciences – clinical medicine, biomedical research, biology; physics – physics, earth and space sciences; chemistry; engineering; mathematics. All countries which published at least 50 first authored papers in the field in question during the periods of study were included.

Table 1 shows an extract from the various tables appearing in References 1 and 2. A worrisome slowing down of the Indian science is apparent. While the world output increased by 9.7% from the first half to the second half of the decade, India's contribution dropped by an alarming 17.8%. There was a gradual decline in all areas of science, except for engineering, where India barely held its own share of world output.

These are crude measures relating to quantity. Measures of quality in terms of citation impact from References 1 and 2 show that although India had the 10th rank among 173 countries when ranking was done by percentage share in world publication output in 1985–1989 for all science fields combined, its rank dropped to 70 when ranking was done using the mean observed citation rate as a percentage of the world average during the same period. It cannot, therefore, be argued that an actual trimming down of excess fat to produce work of better quality was taking place during the decade.

Table 1. India's publication output (world share in brackets) and change from 1980–84 to 1985–89

	1980–84	1985–89	Change from 1980–84 to 1985–89
Life sciences	21,570 (1.9%)	15,909 (1.3%)	–26.2%
Engineering	6746 (3.2%)	7586 (3.2%)	+12.5%
Mathematics	1846 (3 6%)	883 (1.9%)	–52.2%
Physics	12,687 (3.4%)	11,598 (2.7%)	–8.6%
Chemistry	14,030 (5.3%)	11,718 (4.1%)	–16.5%
All sciences	57,655 (2.8%)	47,372 (2.1%)	–17.8%
World total for all sciences	2,026,902	2,223,883	+ 9.7%