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EDITORIAL

Probing Misconduct: Treading a Dangerous Path

There is nothing more debilitating in a journal editor's life than to be involved in a discussion of a case of scientific misconduct. The issues involved are often contentious, unpleasant and difficult to understand, with the ever-present danger of being accused of bias and malice by all the parties involved. Discussions of the ethics of practising science often transmute into debates on the ethics of journal editors, who make the decisions on publishing or refusing material pertaining to a specific case. Often, and this journal is no exception, the editor is also an active researcher raising the bogey of motivated judgement and conflicts of interest. It is therefore with a considerable degree of misgiving, that I chose to write this column, introducing to readers the case of alleged misconduct at the National Centre for Cell Science (NCCS), Pune, which is considered at some length in this issue. The discerning reader will note that I have used the qualifier 'alleged', because both law and common sense dictate that anyone accused of an offence is innocent until proven guilty. In cases of data manipulation and fabrication, guilt is sometimes not easy to establish. Even more importantly, in the increasingly complex world of modern science, in multi-author papers the individual perceptions on responsibility for specific pieces of data can differ.

The NCCS case, like most such problems, begins with an anonymous e-mail to the head of the institution. One of the charges is that a Figure published in a paper in 2005 (Rangaswami *et al.*, *J. Biol. Chem.*, **280**, 19381) is a reproduction of a Figure published in 2004 (Rangaswami *et al.*, *J. Biol. Chem.*, **279**, 38921), with only a change of labelling. Simply put, this is alleged to be an example of fabrication of non-existent data. The Figures represent 'Western blots', a favourite of cell biologists studying signal transduction, an area mired in biochemical complexity. With the mounting pressure on journals to look attractive, gel photographs (of all varieties) are cleaned and dressed up in many ways, using many different versions of 'image enhancement' software. To an outsider to the field, one blot looks very much like another, with only the legends to figures permitting ready identification. Mislabelling, both intentional and unintentional, can happen. Modern digital technology which permits such facile image storage and manipulation, even by beginning students, also provides the tools to detect 'photo forgeries'. It is precisely such analyses which have been used to address the issue of whether the figures in the two papers from NCCS are identical or not. Matching signatures or fingerprints, in more primitive times, required experts who had learnt to recognize subtle clues in the data placed before them. In the case of the NCCS Western blots, it is a computerized analysis of images that constitutes the basis on which to conclude whether or not an inappropriate act has been committed. At first glance, the problem appears simple. Feed in the images, let the analysis software loose, examine the results and pronounce judgement.

Unfortunately, in the NCCS case there are two conflicting analyses, both of which are described in this issue. The first, conducted by an officially appointed committee chaired by G. Padmanaban, including several active researchers drawn from across the country, comes to the conclusion that the Figures are different and that there is no basis for the allegation of misconduct. The second, initiated by Sohan Modak, was conducted by an independent body, the Society for Scientific Values (SSV), based in Delhi. The SSV, which projects itself as a watchdog of scientific integrity, comes to an unambiguous conclusion that the Figures are deliberately manipulated. Both groups employ image analysis techniques; the former arguing that their conclusions are also based on access to original data, notebooks and interviews with all authors. The waters are further muddied by an independent investigation by the *Journal of Biological Chemistry*, which then proceeded to unilaterally withdraw the 2005 paper. In this case the details of data analysis are unavailable. Finally, there is the complicating factor of an 'internal review' which established a prime facie case, resulting in an attempt by the corresponding author to withdraw the paper under duress. In deciding to publish all the views on this affair, this journal has followed a course that was taken some years ago (*Curr. Sci.*, 2001, **81**, 1389), in which all parties have been given an opportunity to be heard. The authors have been gracious enough to permit a degree of editorial moderation, although it has been difficult to temper the language in all cases. For accusers, there is a great tendency to adopt a strident and judgemental tone; clothed, as they are, in the impregnable armour of self-righteousness. Whistleblowers in India are usually anonymous; their anonymity, presumably, a defence against vindictive institutions and managements. In the NCCS case the charges were publicized, investigated and 'guilty' judgements pronounced by a private body, the SSV. With both libel and privacy laws being largely non-functional in

India, the SSV has been able to take the questionable step of circulating by e-mail and advertising on its website the contents of their findings to large groups of scientists. On the other side, for the defenders there is the tempting option of tarnishing the image of the accusers; malicious intent to destroy institutional and individual reputations is easy to allege, and is sometimes true. In the heat and dust of accusation and counter-accusation, the original problem recedes into the background and a new charge of institutional complicity in a cover-up emerges. In the NCCS case the focus has shifted; the accusers, represented in the published correspondence by Modak, challenging the competence and at times, by implication, the intentions of the Padmanaban committee.

A feature of most discussions on misconduct in India is the pervasive view that there is a malignant 'Indian scientocracy', which seeks to influence all investigations of fraud. ('Scientocracy' is a curious word which could arise by a fusion of 'scientist' with 'aristocracy' or alternatively, with 'bureaucracy'. The former conjures up a vision of a decadent upper class with deteriorating moral values, while the latter invokes an image of a stonewall, defending wrongdoers). The SSV and its proponents therefore argue that an empowered, privately constituted group of 'vigilantes' would be the best way to raise the ethical standards of scientific practice in India. Here, I am reminded of Lewis Carroll's famous line: ' "I'll be judge, I'll be jury", said cunning old Fury'. There is also the oft-stated assumption that the treatment of alleged misconduct cases is carried out more efficiently in other parts of the world. Although the Office of Research Integrity (ORI) was set up over twenty years ago in the USA, the number of cases resolved is only the tip of the iceberg. Institutions struggle with their internal investigations and the fate of whistleblowers remains a matter of concern. A sad and disturbing case at the University of Wisconsin, which hinges curiously enough on manipulated Western blots, ended last year with the resignation of a professor, leaving questions about the veracity of data in three published papers in *Nature Structural and Molecular Biology*, *Developmental Biology* and *Molecular Cell* (Couzin, J., *Science*, 2006, **313**, 1222). Over nine months after this report, none of these papers has been withdrawn, with one journal reportedly waiting for the results of an ORI investigation. The reluctance of journals to publicly state a position on these papers is in sharp contrast to the treatment of the NCCS paper by the *Journal of Biological Chemistry*. It is difficult to avoid the suspicion of bias; I raise this even at the risk of being described as a 'scientocrat' who 'resorts to calling it India bashing' with the intention of whitewashing 'the misdeeds exposed by *JBC* and SSV' (Modak, S., *Curr. Sci.*, 2007, **92**, 1469).

In order to dispel any impression that it is only Western blots and cell biology that throw up cases worth investigating, I must cite the example of Purdue University and the 'bubble fusion' controversy. Here the University has struggled to resolve an issue, which surfaced following publication of a dramatic result over four years ago (Taleyarkhan, R. P., *Science*, 2002, **295**, 1868). A third investigation has now been launched, even though two earlier probes did not definitively establish fabrication of a result (*Nature*, 2007, **447**, 238). In such situations, resolution of a case can be a long drawn-out affair. Indian institutions must learn from many of these experiences in order to address the problem of setting up fair and credible investigations. The job of probing misconduct can be arduous, if approached with a completely open mind. In small institutions (and many of our high profile laboratories are miniscule in size), it will be very difficult to set up impartial internal reviews. Including members from other disciplines can bring a much needed freshness to an investigation. Bodies that arrogate to themselves the power to pass judgements, with little regard for individual rights, need to understand that their quarrels with the scientific establishment cannot be settled at the expense of ordinary researchers, who must have the right to defend themselves, when accused of wrongdoing. In the NCCS case the SSV does not seem to have taken the trouble to ensure that the first author of the *JBC* 2005 paper had a chance to review and respond to the charges, although it may be argued that they have no *locus standi* to ask for a response. It is finally, the student who collected and organized the data, who stands firmly accused of fabrication. Supervisors can be charged in the worst case with complicity, or in the best case, with poor supervisory practice.

What then is the final resolution? If the verdict is 'not guilty' the authors can go back to work, undoubtedly scarred by the stresses and strains of a long drawn-out public controversy. Life may never be the same again. If the verdict is 'guilty', what is the punishment? This is a most difficult problem for institutions to address. Punishments must fit the crime. In the age of scientometrics the behaviour of scientists is conditioned by the tyranny of the journal impact factor. The pressures to publish in the most sought-after journals are impossibly high for those with overwhelming personal ambition. Stepping over boundaries between right and wrong is not uncommon. Indeed a recent study appears to provide a correlation between high retraction rates and high impact factors (Cokol, M. *et al.*, *EMBO Rep.*, 2007, **5**, 422); Butler, D. and Hogan, J., *Nature*, 2007, **447**, 236). Major errors of judgement are often committed under the intense pressures for quick success in brutally competitive, high-profile institutions. Do these merit the harshest treatment of dismissal and denial of degrees, or is there room for reprimand, punishment and rehabilitation? In science the greatest punishment is the silent censure of peers and the uphill task of attempting to piece together a shattered career. In India there is also the fear, and SSV articulates this concern well, that the 'guilty', if powerfully placed, will remain untouched and at times, be further strengthened by recognition and elevation. Investigations of alleged scientific misconduct must tread a dangerous path. Overzealousness can give the impression of a witch-hunt, while inadequate attention invites the charge of a cover-up.

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