

Something Rotten At The Core Of Science?

By David F. Horrobin

The US Supreme Court has recently been wrestling with the issues of the acceptability and reliability of scientific evidence. In its judgement in the case of *Daubert versus Merrell Dow*, the Court attempted to set guidelines for US judges to follow when listening to scientific experts. Whether or not findings had been published in a peer-reviewed journal provided one important criterion. But in a key caveat, the Court emphasised that peer review might sometimes be flawed and therefore this criterion was not unequivocal evidence of validity or otherwise. A recent analysis of peer review adds to this controversy by identifying an alarming lack of correlation amongst reviewers' recommendations.

Many scientists and lawyers are unhappy about the admission by the top legal authority in the US, the US Supreme Court, that peer review might in some circumstances be flawed¹. David Goodstein, writing in a *Guide to the Federal Rules of Evidence*, one of whose functions is to interpret the judgement in the case of *Daubert versus Merrell Dow Pharmaceuticals*, states that 'Peer review is one of the sacred pillars of the scientific edifice'². In public, at least, almost all scientists would agree. Those who disagree are almost always dismissed in pejorative terms such as 'maverick', 'failure' and 'driven by bitterness'.

Peer review is central to the organisation of modern science. The peer-review process for submitted manuscripts is a crucial determinant of what sees the light of day in a particular journal. Fortunately, it is less effective in blocking publication completely; there are so many journals that most even modestly competent studies will be published provided that the authors are determined enough. The publication might not be in a prestigious journal but at least it will get into print.

However, peer review is also the process that controls access to funding and here the situation becomes much more serious. There might often be only two or three realistic sources of funding for a project, and the networks of reviewers for these sources are often interacting and interlocking. Failure to pass the peer-review process might well mean that a project is never funded.

Science bases its presumed authority in the world on the reliability and objectivity of the evidence that is produced. If the pronouncements of science are to be greeted with public confidence - and there is plenty of evidence to suggest that such confidence is low and eroding - it should be able to demonstrate that peer review, 'one of the sacred pillars of the scientific edifice', is a process that has been validated objectively as

a reliable process for putting a stamp of approval on work that has been done.

Peer review should also have been validated as a reliable method for making appropriate choices as to what work should be done. Yet when one looks for that evidence it is simply not there. For 30 years or so, I and others have been pointing out the fallibility of peer review and have been calling for much more openness and objective evaluation of its procedures³⁻⁵.

For the most part, the scientific establishment, its journals and its grant-giving bodies have resisted such open evaluation. They fail to understand that if a process that is as central to the scientific endeavour as peer review has no validated experimental base, and if it consistently refuses open scrutiny, it is not surprising that the public is increasingly sceptical about the agenda and the conclusions of science.

Largely because of this antagonism to openness and evaluation there is a great lack of good evidence either way concerning the objectivity and validity of peer review. What evidence there is does not give confidence but is open to many criticisms. Now, Rothwell and Martyn have thrown a bombshell⁶. Their conclusions are measured and cautious but there is little doubt that they have provided solid evidence of something truly rotten at the core of science.

Rothwell and Martyn performed a detailed evaluation of the reviews of papers submitted to two neuroscience journals. Each journal normally sent papers out to two reviewers. Reviews of abstracts and oral presentations sent to two neuroscience meetings were also evaluated. One meeting sent its abstracts to 16 reviewers and the other to 14 reviewers, which provides a good opportunity for statistical evaluation.

Rothwell and Martyn analysed the correlations among reviewers' recommendations by analysis of variance. Their report should be read in full. However, the conclusions are alarmingly clear. For one journal, the relationships among the reviewers' opinions were no better than that obtained by chance. For the other journal, the relationship was only fractionally better. For the meeting abstracts, the content of the abstract accounted for only about 10-20% of the variance in opinion of referees, and other factors accounted for 80-90% of the variance. These appalling figures will not be surprising to critics of peer review, but they give solid substance to what these critics have been saying. The core system by which the scientific community allots prestige (in terms of oral presentations at major meetings and publication in major journals) and funding is a

non-validated charade whose processes generate results little better than does chance.

Given the fact that most reviewers are likely to be mainstream and broadly supportive of the existing organisation of the scientific enterprise, it would not be surprising if the likelihood of support for truly innovative research was considerably less than that provided by chance.

Scientists frequently become very angry about the public's rejection of the conclusions of the scientific process. However, the Rothwell and Martyn findings, coming on top of so much other evidence, suggest that the public might be right in groping its way to a conclusion that there is something rotten in the state of science. Public support can only erode further if science does not put its house in order and begin a real attempt to develop validated processes for the distribution of publication rights, credit for completed work, and funds for new work. Funding is the most important issue that most urgently requires opening up to rigorous research and objective evaluation.

Could the peer-review processes in both academia and industry have destroyed rather than promoted innovation?

The Rothwell-Martyn bombshell is a wake-up call to the cosy establishments who run science. If science is to have any credibility - and also if it is to be successful - the peer-review process must be put on a much sounder and properly validated basis or scrapped altogether.

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