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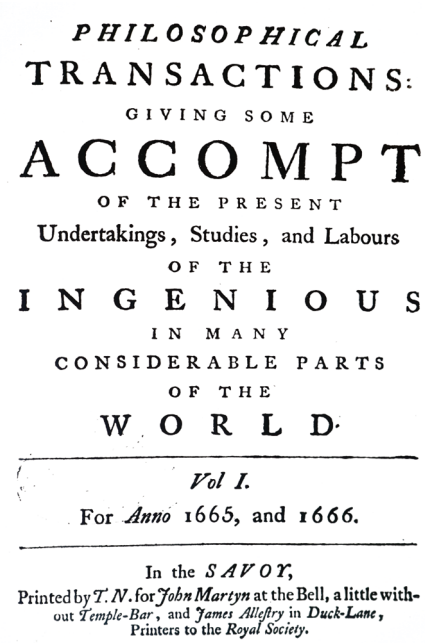
In praise of peer review

Peer review has long been established as the gold standard for scientific publishing, but changes in the publishing ecosystem should not influence author response to the views of their peers.

The concept that a scientific publisher should use judges to assess the correctness of the observations and conclusions of a manuscript goes back to near the start of the scientific age. In 1665, the first issue of *Philosophical Transactions* was published, which from the very beginning noted that members of the Royal Society would informally review submissions[1]. It is surprising that it is much more recently, in 1973, that *Nature* mandated external peer referee reporting for any submitted paper[2]. On the 50th anniversary of mandatory peer review in *Nature*, we reflect on the history of peer review, and changes in the publishing industry as well as best practices during the peer-review process.

Although review of papers in *Philosophical Transactions* was common practice, this was not equivalent to modern peer review. That reviewers should be experts in the areas discussed by the paper was first formally noted in 1731, when the Royal Society of Edinburgh instituted a policy that papers should be sent only to appropriate anonymous members[3]. Peer review did not immediately become the gold standard. Scholarly societies increasingly used external experts to assess papers, but it was not uncommon for a paper to be published without undergoing peer review well into the twentieth century. In 1936, Albert Einstein wrote to the editor of *Physical Review* complaining that his paper was sent to anonymous experts and stating that as the comments of the referees were erroneous, he would not bother responding[4]. Papers such as that published in *Nature* by James Watson and Francis Crick on a model of the structure of DNA were not reviewed externally, rather an endorsement from the head of their institution, the Cavendish Laboratory, was sufficient to guarantee publication[2].

It was only when David Davies became chief editor of *Nature* in 1973 that external peer review in *Nature* became obligatory.



PHILOSOPHICAL
TRANSACTIONS:
GIVING SOME
ACCOMPT
OF THE PRESENT
Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

Vol I.
For Anno 1665, and 1666.

In the SAVOY,
Printed by T. N. for John Martyn at the Bell, a little without Temple-Bar, and James Allestry in Duck-Lane, Printers to the Royal Society.

The first scientific journal that used a basic form of peer review.

Davies, who previously worked at the Massachusetts Institute of Technology, came to the editorship aware that there was a perception at the time that *Nature* was a British establishment journal. To counter this charge, external peer review became mandatory, while the referee pool was widened outside the UK[2].

There have been further innovations in peer review since then. Preprint servers, databases that hold early versions of a scientific paper, such as arXiv, are regularly used in some scientific disciplines. Publication of a preprint does not affect publication in Nature Portfolio journals[5]. Since 2015, double-blind peer review, where authors anonymize manuscripts and the identity of the authors is not passed onto the referees, has been available for papers submitted to Nature Portfolio journals[6]. We also allow voluntary referee recognition. And for submissions from certain communities, such as the life sciences or photovoltaics, we require checklists that are then sent to referees to aid transparency and reproducibility[7].

The scientific publishing ecosystem has also evolved, more papers are being published than ever before with more journals servicing this need. Indeed, for several publishers including Springer Nature it is now easier than ever to transfer submissions from one journal to another, before or after peer review. But here we sound a note of caution, although it is possible after peer review to transfer to another journal using a provided link, this does not necessarily always happen. That is fine and normal, researchers are free to choose which journal to submit to and can submit afresh. This can provide a degree of temptation to resubmit elsewhere without fully addressing concerns or comments raised by experts. The ideals underlying peer review are to judge the quality, impact and correctness of the scientific hypothesis investigated. Good scientific practice for response to peer comments should be to address and acknowledge these points; even if the paper is rejected at the target journal the scientific value of the paper has been strengthened. To simply submit a manuscript elsewhere without addressing technical issues, or even in the extreme to use peer review to discover weaknesses in a manuscript, and so subsequently remove these weak data in a fresh submission elsewhere can be considered as bad scientific practice. Although this may help a paper in the narrow sense of getting accepted, this certainly will not help the paper's long-term and wider impact. After all, many experts will then read the paper, including those original peer referees who had looked at the paper in another journal.

The history of peer review so far has been one of evolution, which we expect to continue. But the core idea of peer review as it is now, to improve manuscript quality from expert feedback, should not be changed.

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