

Peer review is not broken

Despite regular claims to the contrary, our peer review systems are not fundamentally broken, but they do suffer from stresses and strains that require journals to undertake ongoing maintenance, by trialling and adopting new practices while ensuring continued rigor.

Over the past century, a formal system of peer review has evolved for assessing whether conclusions drawn in a scientific study are well supported by the data generated, and whether the advance provided is suited to the journal in which publication is being sought. In general, peer review of a manuscript involves recruiting three or more referees to undertake a thorough assessment of a manuscript and provide written feedback for the authors, to which they can respond with additional experimentation, argumentation or revision to the text — if invited to do so by the journal editors. Myriad variations have been adopted across different journals and fields at different times. On some journals, editors assess the reviewer reports, considering the key issues raised before formulating a decision, while others host a discussion between reviewers and editors to reach a consensus decision. Sometimes, the exchange between the authors and referees will be published alongside the research article, the identity of the referees will be published, or the reviews will even be solicited by the authors themselves and submitted to the journal together with the manuscript. However, the fundamentals of the systems employed are roughly similar for the majority of journals; a selected group of researchers are asked to devote a significant period of time to undertake a careful and detailed assessment of a manuscript, and then provide their thoughts to the journal editors and authors.

All variations of peer review that have been implemented have inherent imperfections, and collectively this has led to suggestions that the entire concept of assessment by selected reviewers is itself broken. Problems identified vary widely and are often contradictory. Some reviewers can be too thorough, nit-picking at every piece of data and argument put forward and asking for extensive and unending additional experimentation. Others may not give a study sufficient scrutiny, enabling potentially flawed data to be published. Anonymity can allow some reviewers to be unnecessarily combative, over-critical, perhaps even biased and conflicted. Conversely, full transparency of reviewer identity, or authors soliciting their own reviews, can lead to problems of power differentials, where the seniority of an author or referee might impact the level

of critical discussion. Even with constructive interaction between reviewers and authors, the process of review and revision can sometimes require multiple rounds, resulting in times from submission to publication that occasionally run to a year or longer. With an increasing number of journal launches (our own included), growth in the number of scientific papers being published has outpaced growth in the size of scientific faculties in parts of the world on which the task of peer reviewing has predominantly fallen. Researchers are expected to publish regularly, and receive frequent invitations to review the work of others. The knock-on effects include a reduced reviewer-acceptance rate, greater difficulty in recruiting an appropriately qualified panel and increased review durations.

Claims that the system supporting the assessment of several-million research articles each year is broken remain a gross overstatement, but this catalogue of strains and stresses clearly needs to be addressed. Notable among the more radical solutions proposed has been post-publication peer review (PPPR), which both informally, through blogs and Twitter, and formally, through platforms such as F1000, PubPeer and PubMed Commons, has provided new avenues for critical discussion and constructive feedback on work already published. There are plenty of examples where PPPR has had a positive (and corrective) impact on published work. However, as yet only a fraction of articles published attract anything like the quality of insightful discussion through PPPR that is regularly seen with pre-publication review. In recent years, life scientists are catching up with physics colleagues in embracing the sharing of non-peer-reviewed preprints, through repositories such as bioRxiv. While intended to aid rapid dissemination of research, but not entirely replace formal peer review upon submission to a journal, such repositories also provide a mechanism for commenting and updating preprint versions. Here again, while examples exist for which discussion of a preprint has improved a work before journal submission, these are a minority. Most preprints garner few or no comments, and many preprints are only deposited concurrently with submission for formal peer review.

So, how does *Nature Microbiology* aim to ensure that work sent out for review receives a rigorous, rapid, yet fair process? First, we select only those studies that we feel are sufficiently mature and provide a compelling conceptual advance, in part to avoid unnecessary work for our reviewers. We invite reviewers based on the specific microbiological and technical demands of a study, and we keep a database of reviewers to which we regularly add new researchers. Our aim is to have a balance of senior researchers and those at earlier stages in their careers; to help train the next generation of reviewers, we encourage principal investigators to co-review together with laboratory members (as long as this is clearly indicated to the journal), but not to delegate responsibility entirely. We honour reviewer exclusions (but may ask authors to scale back their list if it blankets an entire field), and we seek to avoid reviewers who have clear conflicts of interest. Our reviewers are expected to respect the confidentiality of the peer review process and not to share or use the knowledge gained in the process to advance their own studies. Reviewers are free to sign their reports, but we do not mandate it, and if a study's authors wish to, they can opt to have the manuscript sent for double-blind peer review. Importantly, the editorial team takes an active role in assessing the reviews a manuscript receives, discussing whether points raised are fundamental to the conclusions drawn and, if appropriate, overruling reviewers where we feel that requests necessitating additional work would be unreasonable within the scope of the study submitted.

Beyond these basic principles, like other *Nature Research* journals, we are committed to trialling new practices in peer review and adopting them where they prove beneficial. For example, we will shortly be adopting a reviewer accreditation approach that has been trialled in *Nature*, which allows authors to acknowledge and thank reviewers of their study by name at the end of the paper (with reviewer permission). We will continue to develop best practices and to refine and evolve our approach to peer review wherever it can be improved. □

Published online: 18 December 2017
<https://doi.org/10.1038/s41564-017-0093-3>