Peer review

A guide for researchers

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research information network

www.rin.ac.uk

This guide has been produced by The Research Information Network to provide researchers with an understanding of the peer review process and some of the current issues surrounding the debate about peer review.

The guide is available at **www.rin.ac.uk/peer-review-guide**

Hard copies can be ordered to distribute to colleagues, please email catherine.gray@rin.ac.uk

About the Research Information Network

The Research Information Network has been established by the higher education funding councils, the research councils, and the UK national libraries. We investigate how efficient and effective the information services provided for the UK research community are, how they are changing, and how they might be improved for the future. We help to ensure that researchers in the UK benefit from world-leading information services, so that they can sustain their position as among the most successful and productive researchers in the world. All our publications are available on our website at www.rin.ac.uk

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1. What is peer review?

Peer review is both a set of mechanisms and a principle at the heart of the system for evaluating and assuring the quality of research before and after it is funded or published. It involves subjecting research proposals and draft presentations, papers and other publications to critical evaluation by independent experts (peers). The reviewers are usually appointed by the funding body or the editors of a journal or other formal channel for communication to which the work has been submitted.

The origins of peer review are often traced to the scholarly societies of 18th century Britain; but it became an institutionalised part of the scholarly process across all subject domains only in the latter half of the 20th century, in response to the growth of scholarly research and greater subject specialisation. It is not a single process, but rather a flexible set of mechanisms used by funding agencies, scholarly journals and employers across the world as the key means to ensure that only high-quality research is funded, published and appropriately rewarded.

Peer review is applied to a number of activities in the research process, particularly in the context of higher education. There is considerable variety of practice, and it is a merit of the system that there is no single model of good practice. But peer review is employed in:

- the evaluation of applications for funding, to determine which applications are successful
- the review of reports submitted by researchers once their funding award has come to an end, to assess whether a project has been completed satisfactorily
- the evaluation of draft conference presentations, journal articles and monographs, before they are published, to assess whether they meet quality standards
- the evaluation of publications once they have been published, through reviews and review articles, and
- the evaluation of the quality of work produced by individuals, teams, departments and institutions to help determine appointments, promotions and levels of funding.

2. How does it work?

How peer review works: publications

Researchers

submit manuscripts to journal editors or publishers

Some publishers allow researchers to nominate one or more reviewers themselves

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In-house staff

- log and acknowledge receipt
- some journals and publishers employ in-house editors who check to ensure manuscripts fall within the subject scope of the journal or publisher
- larger journals and publishers use in-house editors as an initial quality filter, to determine whether manuscripts should be sent on to academic editors

Some manuscripts such as letters, editorials, commentaries etc may go through a fast-track editorial review process for rapid publication

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Editors and editorial boards

- review the manuscripts submitted to them, for quality and fit with the scope of the journal or publisher
- decide on the experts in the relevant field from whom they will seek assessments

The editorial boards of some journals undertake most of the peer review themselves. More commonly, editors seek views from a much wider range of experts

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Peer reviewers

- examine and assess the application for such matters as research design and methodology; and validity, accuracy, originality and significance of findings
- make a recommendation to accept, reject, or to ask the authors to make modifications and resubmit

Peer reviewers are not paid, though they may be offered a reduced, or free, subscription to the journal. They spend an average of 3-6 hours on a journal article

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Editors

- consider reviewers' assessments and recommendations
- decide to accept or reject, *or*
- invite authors to respond to comments and suggestions

Journal articles may go through a number of cycles of comment and response before they are accepted

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Authors

respond to comments and suggestions

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Editors

make final decision to accept or reject

Submission and rejection rates for journals vary widely. The highest status journals may accept fewer than 10% of manuscripts submitted

How peer review works: grant applications

Researchers

submit applications to funding body

Some funding bodies allow applicants to nominate one or more reviewers themselves

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In-house staff

- log and acknowledge receipt
- check to ensure applications meet basic eligibility criteria
- send to peer reviewers

Many funding bodies have established panels of reviewers, for whom they provide training before they undertake reviews.

The number of reviewers will usually depend on the scale of the funding request, and may range from 2 or 3 up to 6 or 8

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Peer reviewers

- examine and assess the application for such matters as quality and track record of researcher(s), research design and methodology, originality and value for money
- grade in accordance with a pre-determined scale

Peer reviewers are not paid, and may spend up to 8 hours reviewing a proposal

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In-house staff

- receive assessments
- where competition for funds is intense, staff may inform applicants with low grades that their applications have been withdrawn, and provide feedback from reviewers
- for applications that pass a grading threshold, staff may transmit reviewers' comments to applicants, and invite a response

Success rates in UK Research Council competitions averaged around 28% in 2005-06. Since then they have fallen to well under 20% in several competitions

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Researchers

respond to reviewers' comments if given the opportunity

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In-house staff

transmit applications to funding committee

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Funding committee

- consider reviewers' assessments and recommendations, and any responses from applicants
- assign final grades to applications, and agree feedback as appropriate
- make funding decisions

Members of funding committees may individually review and grade applications before the committee meets

3. Support and criticism

Survey evidence (see references section) shows widespread, deep and strong support in the research community for peer review as an essential mechanism to ensure that only high-quality research is funded, published and rewarded. Peer review also plays an important role in enhancing the quality of research: the overwhelming majority of researchers believe that their work is improved as a result of the peer review process.

But peer review also attracts criticism, on the grounds that it brings delay; that it is not always effective in detecting misconduct and malpractice; that the selection of reviewers may introduce bias into the system; that the judgements made are subjective and inconsistent; that it tends toward conservatism and stifles innovation; that it disadvantages interdisciplinary research; and that it imposes increasing and unsupportable burdens on reviewers.

The digital revolution and the growth of new forms of communication between researchers present new challenges as well as opportunities for the development of new forms of peer review. These developments can help to speed up the process, and make it easier to employ international reviewers. They also make it easier for reviewers to do their job well. Papers circulated as pre-prints before formal publication may also be commented on openly by a wide range of researchers; and post-publication reviews may be supplemented by informal commentary in blogs and social networks, as well as recommender systems. However, as the research community grows and the number of journals and funding increases, the more difficult it can be for journals to find reviewers who find time to review, and the system gets more complex.

Peer review: scrutiny and review

As peer review has become a more fundamental part of the research landscape, it has been subject itself to scrutiny and review. In the UK, several reports were commissioned in the light of government concerns about the efficiency and effectiveness of the peer review process. In 1990, the 'Boden Report' for the Advisory Board for the Research Councils' (ABRC) concluded that there were "no practicable alternatives" to peer review, even though the process was "significantly fallible". Five years later, a Royal Society (1995) report reached similar conclusions but stressed the burden imposed on peer reviewers, particularly when success rates are low.

In 2006, Research Councils UK (RCUK) conducted a major study of peer review in the allocation of research funding. The report validated the continued use of peer review as basis for funding decisions but considered a number of options and approaches to improve its efficiency and effectiveness. A British Academy report in 2007 focused on the humanities and social sciences. It again concluded that there were no better alternatives to peer review, and that criticisms were often directed at deficiencies in practice rather than the principle of peer review. More recent reports published by the Publishing Research Consortium (2008) and Sense About Science (2009) have focused on researchers' views and experience as to the peer review of publications, and made recommendations about how it might be improved.

4. Is it effective?

Selecting the best research proposals

As the research community has grown in size, competition for funds has increased. It thus has become more important, and more difficult, to ensure that only the highest-quality research proposals are funded. The RCUK study of peer review in 2006 concluded that a success rate of between 20% and 50% represented "an acceptable balance between the benefits of competition and the cost/effort to support the system". Since then, success rates have fallen further, in some cases to well under 20%; and such levels bring into question not only the balance between competition and cost, but the ability of the system to discriminate between the best and the very best. There are particular risks for intellectually-innovative proposals, where the potential of the approach may be speculative, and where there may be marked differences between the evaluations of different reviewers.

Detecting misconduct and malpractice

One of the key aims of peer review – alongside other mechanisms such as codes of ethics and research practice – is to filter out bad research, including fabrication, falsification, plagiarism, failure to disclose conflict of interests, and other forms of scholarly misconduct. But instances of malpractice and misconduct continue, and since reviewers themselves are fallible, peer review cannot provide a guarantee against the publication of bad research. Hence a number of published papers are retracted each year for a variety of reasons; and there is evidence (Times Higher Education, 2009) that the number is rising.

Editors, publishers and others have established various mechanisms and procedures for dealing with cases where suspicions or reservations are raised about individual pieces of published work, and whether they should retain their place in the records of research. All major publishers have established procedures for handling such cases, and bodies such as the Committee on Publication Ethics (COPE) and the European Association of Science Editors (EASE) provide training and guidance on good practice, as well as (in COPE's case) a forum and other mechanisms to discuss specific instances and issues, provide advice, and deal with disputes.

5. Is it fair? Subjectivity and transparency

Peer review is the mechanism that underpins the selection of what is funded (and by how much), who is appointed and promoted, and what is published. It is not surprising that concerns are frequently expressed as to its fairness. Again because reviewers are not always perfect in their judgements, there can be no doubt that individual cases of unfairness do arise. The key questions are whether the practice of peer review gives rise to systematic unfairness against individuals or groups, and what steps can be taken to guard against unfairness.

Many studies (some of them discussed in the reports shown in the list of references) have sought to investigate whether peer review discriminates against women, younger researchers, those from less-well-favoured institutions, non-native English speakers, or researchers with unconventional views or from outside the mainstream. Taken as a whole, the results of such studies are inconclusive: there is evidence of disadvantage suffered by researchers in all such groups, but it is not clear that this arises from the peer review process itself, or from elsewhere in the arrangements for supporting, appointing, promoting, funding and rewarding researchers. Nevertheless, there is a clear risk that peer review may tend towards conservatism, and/or to reflect the viewpoints and prejudices – acknowledged and unacknowledged – of those appointed to undertake the reviews.

As a check against systematic unfairness, it is clearly important that both the mechanisms and the results of peer review should themselves be subject to regular examination. It is particularly important that there should be rigour and fairness in the selection of reviewers. Some recent reports (see list of references) have also stressed the importance of training and the provision of written guidelines for peer reviewers, and the improvements in the quality and rigour of reviews that have followed from such measures, although at least one study, published in the British Medical Journal, has suggested that short training courses had little impact.

Differing levels of transparency are also important here. Broadly there are three systems currently operating. In double-blind systems, the identities of both the reviewers and the submitters of the proposal or draft publication are hidden; in single-blind systems, reviewers' identities are hidden, but the submitters' identities are not; and in open systems, the identities of both reviewers and submitters are revealed to each.

Degrees of transparency

Double-blind review: the identities of the reviewers and those whose submission is being reviewed are hidden from each other.

Single-blind review: the identities of those who have submitted the proposal or draft publication are revealed to the reviewers, but not vice versa

Open review: this term is used to cover at least three different kinds of arrangement with increasing levels of transparency:

- the identities of reviewers and submitters are revealed to each other
- the signed reviews themselves are passed in full to the applicants, and
- authors' draft publications are made available on websites and reviews and comments are invited from anyone who wishes to do so.

Single-blind review tends to predominate in the sciences, while double-blind review is more common in the humanities and social sciences (where submitters themselves may be allowed to nominate at least one reviewer). Surveys suggest that many scientists would prefer double-blind review in principle. But they also acknowledge that it may be easy to identify authors from references or other internal clues; and reviewers may benefit from knowing the authors' identity in order to place the work in context. It is not clear whether double-blind review decreases the risk of unfairness to women and other groups.

Some people have expressed concerns that the anonymity involved in both single-blind and double-blind systems can shroud reviewer bias, misconduct or abuse, including misappropriation of ideas and data, failure to disclose conflicting or competing interests, or undue or deliberate delays in returning reviews. Such concerns have led to moves towards open review, in the biomedical field in particular, where the *British Medical Journal* has revealed the names of reviewers to authors since 1999. And some researchers believe this can reduce abuses, make referees more accountable and give them more credit for their work. On the other hand, surveys suggest that a substantial majority of researchers wish to retain anonymity for reviewers, fearing it may make juniors less willing to review seniors, inhibit criticism, or make it harder to recruit referees.

6. Is it efficient? Speeding it up and lightening the burden

The long-term growth in size of the research community, and in the volumes of research being undertaken and published, have led to an increasing sense of strain on the peer review system. Concerns focus on two issues: the time taken to reach decisions, and the burdens placed on researchers both as reviewers and as submitters of work to be reviewed.

In a world where the ease and the speed of communication and response has increased significantly in recent years, the delays in decision-making inherent in the peer review system are increasingly seen as irksome. Both funders and publishers have sought to exploit new technologies to speed up their processes. Nevertheless, decisions on applications for research grants may take up to six months or more; and journal editors reported in 2007 (Publishing Research Consortium, 2008) an average of 130 days from submission of a manuscript to acceptance (and further delays beyond that until formal publication).

Some of the delays are inherent in any system of evaluation and assessment, and necessary in the interests of fairness. Thus arrangements for right of reply and for revision and resubmission are desirable in themselves, but bring a cost in time. Other delays arise in the processing of large volumes of submissions, or from the human weaknesses of reviewers and others in failing to meet deadlines. Funders and publishers are seeking to address such issues in various ways, including measures to reduce the number of submissions; the use of pre-review filtering and triage mechanisms; and instituting fast-track review (sometimes for a fee) for certain categories of submissions or proposals.

The burdens on researchers as submitters and reviewers are by far the biggest costs in the peer review system (see box overleaf), and various measures have been proposed to reduce them or at least keep them in check. These include the introduction of disincentives and filtering systems to discourage the submission of lower-quality applications and draft publications. On the reviewer side, they include reducing the number of reviewers per submission, eliminating peer review altogether for some kinds of proposals, and allowing reviewers' reports to pass – with consent on all sides – from one funder or publication to another.

Peer review: who pays?

The vast majority of peer reviewers give their services free of charge, motivated by a commitment to providing a service to the research community of which they are a part. Small payments are made occasionally, but for most reviewers the only reward is acknowledgment – either privately or by inclusion in a list published annually – invitations to receptions and conferences, subsidised or free subscriptions to journals, or waivers of other charges and fees.

Although little if any cash changes hands, the time and other resources spent by publishers in organising peer review, and by reviewers in actually doing it, are considerable. The costs are particularly significant for the highest-quality journals, with correspondingly high rejection rates. A study by RIN (2008) suggests the costs of the time spent by editors and reviewers of scholarly journal articles globally amount by now to £2-3bn, or over a quarter of the total cost of publishing and distributing journal articles; and that the UK contributes about 9% of those costs.

The costs are similarly high for peer review of grant applications. In 2006, Research Councils UK (RCUK) estimated that the cost of preparing and reviewing applications for funding from the UK Research Councils was approximately £196m a year. Again, the costs are particularly high where the rejection rate is high.

Some have suggested that peer reviewers should be paid, and recent studies have indicated that 35%-40% of researchers wish to have payment for the reviews they undertake. But researchers are also fearful that payment would make the cost of publishing too expensive. The RIN has estimated that if payment of the full economic costs (FECs) of peer review were to be made in cash, the costs to UK university libraries of subscriptions to scholarly journals would increase by around 45%. Such figures have led some to conclude that there is no practical way in which the FECs of peer review activity can be recovered. But it is also important that the costs as well as the benefits of peer review activities in underpinning the success of the UK research community should be more explicitly recognised in funding regimes; and that both funders and publishers should ensure that their peer review systems, while robust, are proportionate in terms of the burdens they impose.

7. New challenges and opportunities

The internet has brought new ways of doing research, and communicating and evaluating its results. The popularity of services such as ArXiv – which is widely used in the physics community for the rapid dissemination of papers before they are formally published – effectively separates out the functions of dissemination and evaluation: papers are circulated and read before they have been subject to peer review. In most (but not all) cases, the papers are then peer reviewed – and often revised – before being published in a scholarly journal. There have also been experiments in completely open peer review, where papers are hosted on an open server on the internet for public comment. When *Nature* trialled such a system in 2006, however, it found a 'marked reluctance among researchers to offer open comments'

Post-publication evaluation in the form of reviews and review articles as well as citation – both positive and negative – has been an important part of the peer review system for many years. Some journal publishers are now using web technologies to enable readers to add comments, notes and ratings to individual articles, as signals to subsequent readers. Such developments are welcomed by many, and have led some to suggest that peer review prior to publication should be abandoned altogether, so that all research is communicated as quickly as possible, and evaluated only once it has been published. Others suggest that the obvious benefits of quality control before publication should be retained with lighter-touch and thus speedier (but nonetheless rigorous) peer review, alongside longer-term and systematic evaluations through comments, ratings and so on which could become permanently attached to the article. A number of publishers, particularly in the open access part of the sector, are now developing and implementing such systems.

Changes to texts that were once fixed in print, however, and the availability of multiple and varying versions of papers as pre-prints and post-prints give rise to a number of concerns: how do readers know whether they are reading the peer-reviewed final version of a paper? The CrossRef organisation is therefore developing a 'CrossMark' service to apply a readily-understood logo or kitemark to the publisher-maintained 'version of record'.

But traditional conference presentations, papers and books are no longer the only focus for concerns. The increasing use of digital technologies also means that researchers can communicate their results using not only text and figures, but also a wide range of multimedia formats, along with the data that underpins their reporting of their findings. Research data in particular presents new challenges as well as opportunities for evaluation and peer review. Funders are increasingly keen that research data should be disseminated and made available alongside published research findings. Surveys suggest that researchers are keen in principle to see such data subject to peer review; but they find it difficult to see how this can be achieved in practice without adding hugely to the burdens already placed on peer reviewers, and to delays in decision-making.

Alongside these issues are those raised by researchers' use of blogs, wikis and other Web 2.0 technologies to communicate with their colleagues and more broadly, as well as social tagging services through which they may make their personal reading lists available to others. Use of such services has not yet become widespread across the research community (see RIN 2010 [in press]); and cultures and protocols relating to their use are not as yet well-established. Some commentators, however, see potential for the development of recommender systems with built-in trust metrics that may provide a useful supplement to traditional peer review. The mechanisms of peer review may thus change. But the principle remains at the heart of the system for evaluating and assuring the quality of research.

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Get in touch with us:

Research Information Network
96 Euston Road
London
NW1 2DB

T +44 (0)20 7412 7946
F +44 (0)20 7412 7339
E **contact@rin.ac.uk**
www.rin.ac.uk