Peer review

Peer review (known as **refereeing** in some academic fields) is a process of subjecting an author's scholarly work or ideas to the scrutiny of others who are experts in the field. It is used primarily by publishers, to select and to screen submitted manuscripts, and by funding agencies, to decide the awarding of monies for research. The peer review process is aimed at getting authors to meet the standards of their discipline and of science generally. Publications and awards that have not undergone peer review are likely to be regarded with suspicion by scholars and professionals in many fields. Even refereed journals, however, have been shown to contain error, fraud and other flaws that undermine their information quality.

Contents

A reviewer at the National Institutes of Health evaluates a grant proposal.

Reasons for peer review

A rationale for peer review is that it is rare for an individual author or research team to spot every mistake or flaw in a complicated piece of work. This is not because deficiencies represent needles in a haystack, but because in a new and perhaps eclectic intellectual product, an opportunity for improvement may stand out only to someone with special expertise or experience. Therefore showing work to others increases the probability that weaknesses will be identified, and with advice and encouragement, fixed. The anonymity and independence of reviewers is intended to foster unvarnished criticism and discourage cronyism in funding and publication decisions. However, as discussed below under the next section, US government guidelines governing peer review for federal regulatory agencies require that reviewer identity be disclosed under some circumstances.

In addition, since the reviewers are normally selected from experts in the fields discussed in the article, the process of peer review is considered critical to establishing a reliable body of research and knowledge. Scholars reading the published articles can only be expert in a limited area; they rely to some degree on the peer-review process to provide reliable and credible research which they can build upon for subsequent or related research. As a result, significant scandal ensues when an author is found to have falsified the research included in an article, as many other scholars, and the field of study itself, has relied upon that research. (See below peer review and fraud.)

U.S. Government Peer Review Policies

Most federal regulatory agencies in the United States government must comply with specific peer review requirements before the agencies publicly disseminate certain scientific information. These requirements were published in a peer review Bulletin issued by the White House Office of Management and Budget ("OMB"). The peer review Bulletin (http://www.whitehouse.gov/omb/memoranda/fy2005/m05-03.pdf) for the first time establishes "government-wide standards concerning when peer review is required and, if required, what type of per review processes are appropriate."

OMB's peer review Bulletin requires that US federal regulatory agencies submit all "influential scientific information" to peer review before the information is publicly disseminated. The Bulletin defines "scientific information" as:

"*factual inputs, data, models, analyses, technical information, or scientific assessments related to such disciplines as the behavioral and social sciences, public health and medical sciences, life and earth sciences, engineering, or physical sciences.*"

The OMB peer review Bulletin defines "*influential* scientific information" as

"*scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions. In the term 'influential scientific information,' the term 'influential' should be interpreted consistently with OMB's government-wide information quality guidelines (http://www.whitehouse.gov/omb/fedreg/reproducible2.pdf) and the information quality guidelines of the agency.*"

As noted in the preceding quotation, the peer review Bulletin must be read in conjunction with "OMB's government-wide information quality guidelines and the information quality guidelines of the agency." These guidelines govern the quality of all information disseminated by most US government regulatory agencies. These guidelines are required by a US statute enacted in 2001 called the Data Quality Act (http://www.thecre.com/quality/PL06-554Sec515.html) and also known as the Information Quality Act ("IQA"). OMB states that it prepared the peer review Bulletin pursuant to OMB's authority under the DQA.

The peer review Bulletin provides detailed guidelines for peer review of influential scientific information. The Bulletin applies more stringent peer review requirements to "highly influential scientific assessments,"

"*which are a subset of influential scientific information. A scientific assessment is an evaluation of a body of scientific or technical knowledge that typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best*

professional judgment to bridge uncertainties in the available information."

While the peer review Bulletin's specific guidelines will not be discussed here in detail, one should note that the guidelines differ in several respects from traditional peer review practices at most journals. For example, the Bulletin requires public disclosure of peer reviewers' identities when they are reviewing highly influential scientific assessments. The Bulletin's summary of some of these requirements is set forth below:

"*In general, an agency conducting a peer review of a highly influential scientific assessment must ensure that the peer review process is transparent by making available to the public the written charge to the peer reviewers, the peer reviewers' names, the peer reviewers' report(s), and the agency's response to the peer reviewers' report(s). ... This Bulletin requires agencies to adopt or adapt the committee selection policies (http://www.nationalacademies.org/coi/index.html) employed by the National Academy of Sciences (NAS).*"

The peer review Bulletin specifically addresses the effect of publication in a refereed scientific journal as well the variations and limitations with peer review:

"*Publication in a refereed scientific journal may mean that adequate peer review has been performed. However, the intensity of peer review is highly variable across journals. There will be cases in which an agency determines that a more rigorous or transparent review process is necessary. For instance, an agency may determine a particular journal review process did not address questions (e.g., the extent of uncertainty inherent in a finding) that the agency determines should be addressed before disseminating that information. As such, prior* ***peer review and publication is not by itself sufficient grounds for determining that no further review is necessary***." [Emphasis added]

How it works

A publisher sends advance copies of an author's work or ideas to others who are experts in the field (who serve as the referees). Usually, there are two or three referees. These referees each return an evaluation of the work, including suggestions for improvement, to one of the publisher's editors (typically, most of the referees' comments are eventually seen by the author as well). Scientific journals observe this convention universally.

Referees' evaluations usually include an explicit recommendation of what to do with the manuscript or proposal, often chosen from a menu provided by the journal or funding agency. Most recommendations are along the lines of the following:

- to unconditionally accept the manuscript or proposal,
- to accept it in the event that its authors improve it in certain ways,
- to reject it, but encourage revision and invite resubmission,
- to reject it outright.

During this process, the role of the referees is advisory, and the editor is under no formal obligation to accept the opinions of the referees. Furthermore, in scientific publication, the referees do not act as a group, do not communicate with each other, and typically are not aware of each other's identities. There is usually no requirement that the referees achieve

consensus. Thus the group dynamics is substantially different from that of a jury. In situations where the referees disagree about the quality of a work, there are a number of strategies for reaching a decision.

When an editor receives very positive and very negative reviews for the same manuscript, the editor often will solicit one or more additional reviews as a tie-breaker. As another strategy in the case of ties, editors may invite authors to reply to a referee's criticisms and permit a compelling rebuttal to break the tie. If an editor does not feel confident to weigh the persuasiveness of a rebuttal, the editor may solicit a response from the referee who made the original criticism. In rare instances, an editor will convey communications back and forth between authors and a referee, in effect allowing them to debate a point. Even in these cases, however, editors do not allow referees to confer with each other, and the goal of the process is explicitly not to reach consensus or to convince anyone to change their opinions. Some medical journals, however (usually following the open access model), have begun posting on the Internet the pre-publication history of each individual article, from the original submission to reviewers' reports, authors' comments, and revised manuscripts.

After reviewing and resolving any potential ties, there may be one of three possible outcomes for the article. The two simplest are outright rejection and unconditional acceptance. In most cases, the authors may be given a chance to revise, with or without specific recommendations or requirements from the reviewers.

Traditionally reviewers would remain anonymous to the authors, but this is slowly changing. In some academic fields most journals now offer the reviewer the option of remaining anonymous or not, or a referee may opt to sign a review, thereby relinquishing anonymity. Published papers sometimes contain, in the acknowledgments section, thanks to (anonymous or named) referees who helped improve the paper.

Recruiting referees

At a journal or book publisher, the task of picking reviewers typically falls to an editor. When a manuscript arrives, an editor solicits reviews from scholars or other experts who may or may not have already expressed a willingness to referee for that journal or book division. Granting agencies typically recruit a panel or committee of reviewers in advance of the arrival of applications.

In some disciplines there exist refereed venues (such as conferences and workshops). To be admitted to speak, scholars and scientists must submit papers (generally short, often 15 pages or less) in advance. These papers are reviewed by a "program committee" (the equivalent of an editorial board), who generally requests inputs from referees. The hard deadlines set by the conferences tend to limit the options to either accept or reject the paper.

Typically referees are not selected from among the authors' close colleagues, relatives, or friends. Referees are supposed to inform the editor of any conflict of interests that might arise. Journals or individual editors often invite a manuscript's authors to name people whom they consider qualified to referee their work. Authors are sometimes also invited to name natural candidates who should be *disqualified*, in which case they may be asked to provide justification (typically expressed in terms of conflict of interest). In some disciplines, scholars listed in an "acknowledgments" section are not allowed to serve as referees (hence the occasional practice of using this section to disqualify potentially negative reviewers).

Editors solicit author input in selecting referees because academic writing typically is very specialized. Editors often oversee many specialties, and may not be experts in any of them, since editors may be full time professionals with no time for scholarship. But after an editor selects referees from the pool of candidates, the editor typically is obliged not to

disclose the referees' identities to the authors, and in scientific journals, to each other. Policies on such matters differ between academic disciplines.

Recruiting referees is a political art, because referees are not paid, and reviewing takes time away from the referee's main activities, such as his or her own research. To the would-be recruiter's advantage, most potential referees are authors themselves, or at least readers, who know that the publication system requires that experts donate their time. Editors are at a special advantage in recruiting a scholar when they have overseen the publication of his or her work, or if the scholar is one who hopes to submit manuscripts to that editor's publication in the future. Granting agencies, similarly, tend to seek referees among their present or former grantees. Serving as a referee can even be a condition of a grant, or professional association membership.

Another difficulty that peer-review organizers face is that, with respect to some manuscripts or proposals, there may be few scholars who truly qualify as experts. Such a circumstance often frustrates the goals of reviewer anonymity and the avoidance of conflicts of interest. It also increases the chances that an organizer will not be able to recruit true experts – people who have themselves done work like that under review, and who can read between the lines. Low-prestige journals and granting agencies that award little money are especially handicapped with regard to recruiting experts.

Finally, anonymity adds to the difficulty in finding reviewers in another way. In scientific circles, credentials and reputation are important, and while being a referee for a prestigious journal is considered an honor, the anonymity restrictions make it impossible to publicly state that one was a referee for a particular article. However, credentials and reputation are principally established by publications, not by refereeing; and in some fields refereeing may not be anonymous.

The process of peer review does not end after a paper completes the peer review process. After being put to press, and after 'the ink is dry', the process of peer review continues in journal clubs. Here groups of colleagues review literature and discuss the value and implications it presents. Journal clubs will often send letters to the editor of a journal, or correspond with the editor via an on-line journal club (http://www.journalreview.org/). In this way, all 'peers' may offer review and critique of published literature.

Different styles of review

Peer review can be *rigorous*, in terms of the skill brought to bear, without being highly *stringent*. An agency may be flush with money to give away, for example, or a journal may have few impressive manuscripts to choose from, so there may be little incentive for selection. Conversely, when either funds or publication space is limited, peer review may be used to select an extremely small number of proposals or manuscripts.

Often the decision of what counts as "good enough" falls entirely to the editor or organizer of the review. In other cases, referees will each be asked to make the call, with only general guidance from the coordinator on what stringency to apply.

Very general journals such as *Science* and *Nature* have extremely stringent standards for publication, and will reject papers which report good quality scientific work that they feel are not breakthroughs in the field. Such journals generally have a two-tier reviewing system. In the first stage, members of the editorial board verify that the paper's findings -- if correct -- would be ground-breaking enough to warrant publication in Science or Nature. Most papers are rejected at this stage. Papers that do pass this 'pre-reviewing' are sent out for in-depth review to outside referees. Even after all reviewers recommend publication and all reviewer criticisms/suggestions for changes have been met, papers may still be returned to

the authors for shortening to meet the journal's length limits. With the advent of electronic journal editions, overflow material may be stored in the journals online Electronic Supporting Information archive.

A similar emphasis on novelty exists in general area journals such as the Journal of the American Chemical Society (JACS). However, these journals generally send out all papers (except blatantly inappropriate ones) for peer reviewing to multiple reviewers. The reviewers are specifically queried not just on the scientific quality and correctness, but also on whether the findings are of interest to the general area readership (chemists of all disciplines, in the case of JACS) or only to a specialist subgroup. In the latter case, the recommendation is usually for publication in a more specialized journal. The editor may offer to authors the option of having the manuscript and reviews forwarded to such a journal with the same publishers (e.g., in the example given, Journal of Organic Chemistry, Journal of Physical Chemistry, Inorganic Chemistry,...). if the reviewer reports warrant such a decision (i.e., they boil down to "Great work, but too specialized for JACS: publish in ..."), the editor of such a journal may accept the forwarded manuscript without further reviewing.

Some general area journals, such as Physical Review Letters, have strict length limitations. Others, such as JACS, have Letters and Full Papers sections: the Letters sections have strict length limits (two journal pages in the case of JACS) and special novelty requirements.

More specialized scientific journals such as the aforementioned chemistry journals, *Astrophysical Journal*, and *Physical Review* A/B/C/D/E/... use peer review primarily to filter out obvious mistakes and incompetence, as well as (borderline) plagiarism, overly derivative work, and straightforward applications of known methods. Different publication rates reflect these different criteria: *Nature* publishes about 5 percent of received papers, while *Astrophysical Journal* publishes about 70 percent. The different publication rates are also reflected in the size of the journals.

Screening by peers may be more or less laissez-faire depending on the discipline. Physicists, for example, tend to think that decisions about the worthiness of an article are best left to the marketplace. Yet even within such a culture peer review serves to ensure high standards in what is published. Outright errors are detected and authors receive both edits and suggestions.

To preserve the integrity of the peer-review process, submitting authors may not be informed of who reviews their papers; sometimes, they might not even know the identity of the associate editor who is responsible for the paper. In many cases, alternatively called "masked" or "double-masked" review, the identity of the authors is concealed from the reviewers, lest the knowledge of authorship bias their review; in such cases, however, the associate editor responsible for the paper does know who the author is. Sometimes the scenario where the reviewers do know who the authors are is called "single-masked" to distinguish it from the "double-masked" process. In double-masked review, the authors are required to remove any reference that may point to them as the authors of the paper.

While the anonymity of reviewers is almost universally preserved, double-masked review (where authors are also anonymous to reviewers) is not always employed. Critics of the double-masked process point out that, despite the extra editorial effort to ensure anonymity, the process often fails to do so, since certain approaches, methods, notations, etc., may point to a certain group of people in a research stream, and even to a particular person. Proponents of the single-masked process argue that if the reviewers of a paper are unknown to each other, the associate editor responsible for the paper can easily verify the objectivity of the reviews. Single-masked review is thus strongly dependent upon the goodwill of the participants.

Criticisms of peer review

One of the most common complaints about the peer review process is that it is slow, and that it typically takes several months or even several years in some fields for a submitted paper to appear in print. In practice, much of the communication about new results in some fields such as astronomy no longer takes place through peer reviewed papers, but rather through preprints submitted onto electronic servers such as arXiv.org.

In addition, some sociologists of science argue that peer review makes the ability to publish susceptible to control by elites and to personal jealousy. The peer review process may suppress dissent against "mainstream" theories. Reviewers tend to be especially critical of conclusions that contradict their own views, and lenient towards those that accord with them. At the same time, elite scientists are more likely than less established ones to be sought out as referees, particularly by high-prestige journals or publishers. As a result, it has been argued, ideas that harmonize with the elite's are more likely to see print and to appear in premier journals than are iconoclastic or revolutionary ones, which accords with Thomas Kuhn's well-known observations regarding scientific revolutions.

However, others have pointed out that there is a very large number of scientific journals in which one can publish, making control of information difficult. In addition, the decision-making process of peer review, in which each referee gives his opinions separately and without consultation with the other members, is intended to mitigate some of these problems.

While some believe passing the peer-review process is a certification of validity, those who study that process often hold a far more skeptical view. Drummond Rennie, deputy editor of Journal of the American Medical Association is an organizer of the International Congress on Peer Review and Biomedical Publication, which has been held every four years since 1986 [9] (http://jama.ama-assn.org/cgi/content/full/289/11/1438). He remarks, "There seems to be no study too fragmented, no hypothesis too trivial, no literature too biased or too egotistical, no design too warped, no methodology too bungled, no presentation of results too inaccurate, too obscure, and too contradictory, no analysis too self-serving, no argument too circular, no conclusions too trifling or too unjustified, and no grammar and syntax too offensive for a paper to end up in print." [10] (http://www.aaskolnick.com/naswmav.htm)

Peer Review Failures

Peer review failures occur when a peer-reviewed article contains obvious fundamental error(s) that undermines at least one of its main conclusions. Peer review is not considered a failure in cases of deliberate fraud by authors. Letters-to-the-editor that correct major errors in articles are a common indication of peer review failures. Few journals have a procedure to deal with peer review failures beyond publishing letters. Some do not even publish letters. The author of a disputed article is allowed a published reply to a critical letter. Neither the letter or the reply is usually peer-reviewed, and typically the author rebuts the corrections. Thus, the readers are left to decide for themselves if there was a peer review failure.

The letter correction process at the Journal of the American Medical Association ("JAMA") is a failure. JAMA published [JAMA, May 24, 2006; 295(20): 2407 - 2410 (http://jama.ama-assn.org/cgi/content/extract/295/20/2407)] a Commentary by Dr. Linda Rosenstock that contained numerous factual errors (http://www.thecre.com/pdf/CRE%20JAMA%20Response.pdf) as well as considerable political propaganda. For example, the Commentary misstated the basis for the EU's ban on the herbicide atrazine, which was politics not science. The Commentary misstated the IARC classification of atrazine with regard to carcinogenicity. The Commentary misstated that atrazine tests performed by Dr. Tyrone Hayes were accurate and reliable, when in fact Dr. Hayes' tests flunked peer review. (http://thecre.com/pdf/20051222_hayes_white.pdf) The Commentary misstated that the DQA has no legislative history

(http://www.thecre.com/quality/20041010_regweek.htm), when in fact it has substantial legislative history. The Commentary misrepresented several Data Quality Act requests for correction filed by the Center for Regulatory Effectiveness. (http://www.thecre.com/index.html)

The Center for Regulatory Effectiveness attempted to correct the errors through a letter, but failed when JAMA editors imposed length and content constraints that made correction impossible. Consequently, the Rosenstock Commentary is widely cited now even though it contains numerous errors and has no value.

An alternative method of dealing with peer review failures is correction via another peer-reviewed article. For example, a claim that the plant hormone, ethylene, increased plant membrane permeability[1] was shown to be an artifact caused by the low pH of the ethylene-releasing chemical, (2-chloroethyl)-phosphonic acid, employed.[2] One disadvantage of this approach is that a reader who spots major flaws in an article may not have the time or resources to do the research and writing required for a peer-reviewed rebuttal article.

A famous peer review failure was the 1977 *Science* article on the dodo and seed germination[3] that lacked the required control treatment for its main experiment among other major flaws.[4] Another glaring peer review failure involved a 1993 *Bioscene* article[5] on Jan Baptist van Helmont. It had several major factual errors and no references for those supposed facts.[6] *Bioscene* refused to publish a letter pointing out the factual errors and would not consider publishing a peer-reviewed article correcting the original article.

Acknowledged deviations from the idealized outcome of the peer review process are readily observable at both extremes: successful without peer review prior to publication on the one hand; and unsuccessful despite peer review on the other extreme. Among the widely known examples of work later acknowledged to be successful without peer review prior to publication is that of Watson and Crick's 1953 paper on the structure of DNA published in *Nature*[7]. It also served as a rebuttal to a peer review failure.[8] A widely known example of the other extreme is the Jacques Benveniste affair, where peer review was exercised prior to publication in the journal *Nature* and the published results were unable to be replicated by other researchers.

Dynamic and Open Peer Review

In 2006, a group of UK academics launched the online journal Philica, which tries to redress many of the problems of traditional peer review. Unlike in a normal journal, all articles submitted to Philica are published immediately and the review process takes place afterwards. Reviews are still anonymous, but instead of reviewers being chosen by an editor, any researcher who wishes to review an article can do so. Reviews are displayed at the end of each paper, and so are used to give the reader criticism or guidance about the work, rather than to decide whether it is published or not. This means that reviewers cannot suppress ideas if they disagree with them. Readers use reviews to guide what they read, and particularly popular or unpopular work is easy to identify.

Another approach that is similar in spirit to Philica is that of a dynamical peer review site Naboj (http://www.naboj.com/). Unlike Philica, Naboj is not a full-fledged online journal, but rather it provides an opportunity for users to write peer reviews of preprints at arXiv.org. The review system is modeled on Amazon (http://www.amazon.com/) and users have an opportunity to evaluate the reviews as well as the articles. That way, with a sufficient number of users and reviewers, there will be a convergence towards better quality of the review process.

In June 2006, *Nature* launched an experiment in parallel open peer review - some papers that have been submitted to the regular confidential process will also be available for open, identified public comment on the web.[11] (http://blogs.nature.com/nature/peerreview/trial/)

History of peer review

Peer review has been a touchstone of modern scientific method only since in the middle of the twentieth century.[12] (http://www.designinference.com/documents/05.02.resp_to_wein.htm) Before then, its application was lax. For example, Albert Einstein's revolutionary "Annus Mirabilis" papers in the 1905 issue of *Annalen der Physik* were not peer-reviewed. The journal's editor in chief (and father of quantum theory), Max Planck, recognized the virtue of publishing such outlandish ideas and simply had the papers published; none of the papers were sent to reviewers. The decision to publish was made exclusively by either the editor in chief, or the co-editor Wilhelm Wien—both certainly 'peers' (who were later to win the Nobel prize in physics), but this does not meet the definition of "peer review" as it is currently understood. At the time there was a policy that allowed authors much latitude after their first publication. In a recent editorial in Nature, it was stated that "in journals in those days, the burden of proof was generally on the opponents rather than the proponents of new ideas."

Peer review and fraud

Peer review, in scientific journals, assumes that the article reviewed has been honestly written, and the process is not designed to detect fraud. The reviewers usually do not have full access to the data from which the paper has been written and some elements have to be taken on trust (except perhaps in subjects such as mathematics).

The number and proportion of articles which are detected as fraudulent at review stage is unknown. Some instances of outright scientific fraud and scientific misconduct have got through review and were detected only after other groups tried and failed to replicate the published results.

An example is the case of Jan Hendrik Schön, in which a total of fifteen papers were accepted for publication in the top ranked journals *Nature* and *Science* following the usual peer review process. All fifteen were found to be fraudulent and were subsequently withdrawn. The fraud was eventually detected, not by peer review, but after publication when other groups tried and failed to reproduce the results of the paper.

More recently the Norwegian scientist Jon Sudbø published fraudulent articles in The Lancet. He is currently under investigation.

An example of what can happen within academic publications even with peer-review is that of NYU Physics Professor Alan Sokal's publication of *Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity* (http://www.physics.nyu.edu/faculty/sokal/transgress_v2/transgress_v2_singlefile.html) in the journal *Social Text* (http://muse.jhu.edu/journals/social_text/). The submission for publication by Sokal was a hoax that became known as the Sokal Affair.

Peer review and plagiarism

A few cases of plagiarism by historians have been widely publicized.[9] A poll of 3,247 scientists funded by the U.S. National Institutes of Health found 0.3% admitted faking data, 1.4% admitted plagiarism, and 4.7% admitted to

autoplagiarism.[10] Autoplagiarism involves an author republishing the same material or data without citing their earlier publication(s). An author often uses autoplagiarism to pad their list of publications. Sometimes reviewers detect cases of likely plagiarism and bring them to the attention of the editor. Reviewers generally lack access to raw data but do see the full text of the manuscript. Thus, they are in a better position to detect plagiarism or autoplagiarism of prose than fraudulent data.

Although more common than plagiarism, journals and employers often do not punish authors for autoplagiarism. Autoplagiarism is against the rules of most peer-reviewed journals, which usually require that only unpublished material be submitted.

Abuse of inside information by reviewers

A related form of professional misconduct that is sometimes reported is a reviewer using the not-yet-published information from a manuscript or grant application for personal or professional gain. The frequency with which this happens is of course unknown, but the United States Office of Research Integrity has sanctioned reviewers who have been caught exploiting knowledge they gained as reviewers.

Peer review and software development

Peer review of policy

The technique of peer review is also used to improve government policy. In particular, the European Union uses it as a tool in the 'Open Method of Co-ordination' of policies in the fields of employment and social inclusion.

A programme of peer reviews in active labour market policy (http://www.almp.org/) started in 1999, and was followed in 2004 by one in social inclusion (http://www.peer-review-social-inclusion.net/). Each programme sponsors about eight peer review meetings in each year, in which a 'host country' lays a given policy or initiative open to examination by half a dozen other countries and relevant European-level NGOs. These usually meet over two days and include visits to local sites where the policy can be seen in operation. The meeting is preceded by the compilation of an expert report on which participating 'peer countries' submit comments. The results are published on the web.

References

1. ^ Poovaiah, B.W. 1979. Effects of inorganic cations on Ethephon-induced increases in membrane permeability. *J. Amer. Soc. Hort. Sci.* 104: 164-166.
2. ^ Reid, M.S., Paul, J.L. and Young, R.E. 1980. Effects of pH and ethephon on betacyanin leakage from beet root discs. *Plant Physiology* 66: 1015-1016. [1] (http://www.plantphysiol.org/cgi/content/abstract/66/5/1015?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=paul%2C+j&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT)
3. ^ Temple, S.A. 1977. Plant-animal mutualism: Coevolution with dodo leads to near extinction of plant. *Science* 197: 885-886.
4. ^ Hershey, D.R. 2004. The widespread misconception that the tambalacoque or calvaria tree absolutely required the dodo bird for its seeds to germinate *Plant Science Bulletin* 50: 105-108. [2] (http://www.botany.org/PlantScienceBulletin/psb-2004-50-4.php#Dodo)
5. ^ Allchin, D. 1993. Reassessing van Helmont, reassessing history. *Bioscene: Journal of College Biology Teaching*

19(2):3-5.[3] (http://papa.indstate.edu/amcbt/volume_19/v19-2p3-5.pdf)
6. ^ Hershey, D.R. 2003. Misconceptions about Helmont's willow experiment. *Plant Science Bulletin* 49:78-84. [4] (http://www.botany.org/bsa/psb/2003/psb49-3.html#Misconceptions)
7. ^ Watson J.D. and Crick, F.H.C. 1953. A structure for Deoxyribose Nucleic Acid. *Nature* 171: 737-738. [5] (http://www.nature.com/nature/dna50/watsoncrick.pdf)
8. ^ Pauling, L. and Corey, R. B. 1953. A proposed structure for the nucleic acids. *Proc Natl. Acad. Sci. U.S.A." 39 (2): 84-97.* [6] (http://www.pubmedcentral.gov/articlerender.fcgi?tool=pmcentrez&artid=1063734)
9. ^ Historians on the Hot Seat [7] (http://hnn.us/articles/1081.html)
10. ^ Weiss, Rick. 2005. Many scientists admit to misconduct: Degrees of deception vary in poll. Washington Post. June 9, 2005. page A03. [8] (http://www.washingtonpost.com/wp-dyn/content/article/2005/06/08/AR2005060802385.html)

See also

- Academic conference
- Academic journal
- Abstract management
- Adversarial review
- Code review
- Journal Club
- Objectivity
- Open Peer Commentary
- Publication bias
- Scholarly method
- Sokal affair
- Sternberg peer review controversy
- SWoRD System (Scaffolded Writing and Rewriting in the Discipline)

Wikipedia: Peer review

External links

- Post Publication Peer Review of all medical literature (via JournalReview.org) (http://www.journalreview.org/)
- Beyond Open Access: Open Discourse, the next great equalizer (http://www.retrovirology.com/content/3/1/55), *Retrovirology* 2006, 3:55
- Nature peer review debate (http://www.nature.com/nature/peerreview/debate/) June 2006
- Fifth International Congress on Peer Review and Biomedical Publication (http://www.ama-assn.org/public/peer/peerhome.htm)
- The Maharishi Caper: Or How to Hoodwink Top Medical Journals, The Newsletter of the National Association of Science Writers (http://www.aaskolnick.com/naswmav.htm)
- Peer review and the acceptance of new scientific ideas (http://www.senseaboutscience.org.uk/pdf/PeerReview.pdf) (*Warning:* 469 kB PDF)
- Sense About Science: Peer Review (http://www.senseaboutscience.org.uk/peerreview/) Features the PDF pamphlet "I don't know what to believe..."

- "Measuring the quality of peer review" (http://jama.ama-assn.org/cgi/content/abstract/287/21/2786) *Journal of the American Medical Association* 287: 2786–2790 (2002).
- Peer review – process, perspectives and the path ahead (http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2001;volume=47;issue=3;spage=210;epage=4;aulast=Gitanjali)
- Something Rotten at the Core of Science? (http://www.digibio.com/archive/SomethingRotten.htm)
- Malice's Wonderland: Research Funding and Peer Review (http://post.queensu.ca/~forsdyke/peerrev1.htm)
- Is agreement between reviewers any greater than would be expected by chance alone? (http://brain.oxfordjournals.org/cgi/content/full/123/9/1964)
- Peer Review as Scholarly Conformity (http://www.uow.edu.au/arts/sts/bmartin/dissent/documents/ss/ss5.html)
- Science and Politics: An Uneasy Mix (http://www.geosociety.org/science/csf/0407gt.htm)
- The case against peer-review (http://slate.msn.com/id/2116244)
- The Peer-Review Cartel (http://gv.agora.eu.org/article.php3?id_article=934) Rajiv Malhotra (Outlook India, 2004)
- Medical Peer Review (http://www.allmedmd.com/)
- Peer review: the Holy Office of modern science (http://naturalscience.com/ns/articles/01-02/ns_mh.html)
- The end of the Peer Show - scientists' misguided attempt to solve a non-existent problem (http://www.mantleplumes.org/PeerReview.html)
- The philosophical basis of peer review and the suppression of innovation (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=90156666&dopt=Abstract)
- Peer review is broken. (http://www.scienceboard.net/community/perspectives.142.html)
- Suppressing Dissent in Science (http://www.thegreatboycott.net/Dissent_in_Science.html)
- Hampering the progress of science by peer review and by the 'selective' funding system (http://www.tribunes.com/tribune/art96/bere.htm)
- A Case Study of Data Suppression and Misrepresentation (http://ehp.niehs.nih.gov/members/2005/7716/7716.html)
- "A Difficult Balance: Editorial Peer Review in Medicine" (http://www.garfield.library.upenn.edu/histcomp/lock-difficult-bal_2/index-lcs.html)
- A STUDY IN SUPPRESSION OF INFORMATION (http://www.truthinlabeling.org/l-manuscript.htm)
- Suppression of Dissent in Science (http://www.mindfully.org/Reform/Suppression-Of-Dissent.htm)
- Refereed Journals: Do They Insure Quality or Enforce Orthodoxy? (http://www.iscid.org/boards/ubb-get_topic-f-10-t-000059.html) Frank J. Tipler
- Peer-review system (http://www.int-res.com/discussion-forums/meps-discussion-forum-2/) Discussion forum
- The peer-review system: time for re-assessment? (http://www.int-res.com/abstracts/meps/v192/p305-313/)
- Philip E. Bourne, Alon Korngreen, "Ten Simple Rules for Reviewers" (http://dx.doi.org/10.1371/journal.pcbi.0020110), *PLoS Computational Biology*, 2(9):e110, 2006 September. General guidelines for reviewing.
- Stevan Harnad:
    - 2003: PostGutenberg Peer Review (http://www.ecs.soton.ac.uk/~harnad/Temp/peerev.pdf)
    - 2002: Self-Selected Vetting vs. Peer Review: Supplement or Substitute? (http://www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/2341.html)
    - 2001: A Note of Caution About "Reforming the System" (http://www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/1170.html)
    - 1999: Peer Review Reform Hypothesis-Testing (http://www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/0480.html)

    - 1998: The Invisible Hand of Peer Review (http://www.nature.com/nature/webmatters/invisible/invisible.html) Nature (http://en.wikipedia.org/wiki/Nature_magazine) version; Exploit Interactive (http://www.exploit-lib.org/issue5/peer-review/) version
    - 1997: Learned Inquiry and the Net: The Role of Peer Review, Peer Commentary and Copyright (http://eprints.ecs.soton.ac.uk/2633/)
    - 1996: Implementing Peer Review on the Net: Scientific Quality Control in Scholarly Electronic Journals (http://eprints.ecs.soton.ac.uk/2900/)
    - 1985: Rational disagreement in peer review (http://eprints.ecs.soton.ac.uk/3397/)
    - 1984: Commentaries, opinions and the growth of scientific knowledge (http://eprints.ecs.soton.ac.uk/3395/)
    - 1982: Peer commentary on peer review: A case study in scientific quality control (http://eprints.ecs.soton.ac.uk/3389/)
    - 1979: Creative disagreement (http://eprints.ecs.soton.ac.uk/3387/)
- 1978 Behavioral and Brain Sciences (BBS) editorial (http://www.ecs.soton.ac.uk/~harnad/Temp/Kata/bbs.editorial.html)

Categories: Spoken articles | Academic publishing | Scientific method