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EDITORIAL
Is Peer Review Censorship?[▽]

"A censor is an expert in cutting remarks."
—Laurence J. Peter (22)

Given the unpleasantness of having one's work rejected (10), as well as a desire for more-rapid communication of scientific findings, some scientists have expressed nostalgia for the good old days when nearly any submitted manuscript was accepted for publication, and some have even compared peer review to censorship (23, 27). After all, neither Newton nor Darwin had to submit to the indignity of peer review prior to publication! In this commentary we explore the latitude provided to authors in scientific manuscripts and attempt to distinguish the processes of peer review and censorship. In dissecting these issues, we hope to provide authors of *Infection and Immunity* with tools for approaching the comments and criticisms that inevitably follow peer review. Furthermore, we hope that delineating the differences between peer review and censorship will encourage flexibility in authors, reviewers, and editors when dealing with controversial and speculative viewpoints.

To approach this question, we might first consider the historical relationship of science to other disciplines. At the outset of the scientific revolution, the major struggle of science was with religion. The ordeals of Galileo provide a case in point. Although Galileo is a scientific luminary, in his time he encountered problems with peer review by the Inquisition. Objections from church-appointed reviewers were not merely dogmatic. Significant questions were raised with regard to the heliocentric theory, including the fact that it could not explain the absence of stellar parallax. The problem of parallax reflected the fact that, according the heliocentric theory, the angle to a star should change with the time of year as the earth goes around the sun. This was a legitimate scientific criticism that would not be resolved until the 19th century, when technological advances allowed Friedrich Bessel to make the first demonstration of stellar parallax. Galileo was in fact not the first astronomer to run afoul of church censors, as Vatican Decree XXI had already declared that "This whole chapter can be deleted because it admittedly deals with the truth of the earth's motion," in reference to Copernicus' *De Revolutionibus* (9). Although associating the Inquisition and contemporary scientific peer review may seem extreme, a case can be made that the Inquisition represented a review by Galileo's learned peers. Despite the scientific criticisms of the heliocentric theory and pleas to soften his claims, Galileo was initially defiant and recanted only when shown the instruments of torture. In our experience, *Infection and Immunity* authors are generally happy to make revisions to get their papers accepted, and encouragement from torture devices is hardly ever needed anymore. Hence, things do appear to have changed for the better in the area of scientific publishing.

Censorship is defined by the dictionary as "examination in order to suppress or delete anything considered objectionable" (1). The word originates from the Roman censors, magistrates charged with both taking the census (for tax purposes) and maintaining public morality, or regimen morum. Peer review has been more specifically defined as "the evaluation of scientific research findings for competence, significance and originality by qualified experts" (4, 5). Peer review of manuscripts as it presently exists is taken for granted, but its history is much more recent than that of censorship. Although the peer review of scientific manuscripts dates back to the Royal Society of Edinburgh in 1731, peer review was irregularly performed by most journals until the latter half of the 20th century. While some journals, like the *British Medical Journal*, routinely sent all manuscripts to outside experts for an opinion prior to publication, *Science* and *JAMA* did not employ outside reviewers until 1940, relying only on editors' assessments for publication decisions, and the *Lancet* did not implement external peer review until 1976 (4, 6, 30). The critical technological advance of the photocopier in 1959 greatly facilitated the dissemination of manuscripts to multiple reviewers, and the recent development of the internet has further enhanced the process.

Peer review became essential because new incentives for publication dramatically increased the number of research papers. (PubMed lists more than 700,000 articles published during the past year alone.) Peer review allows journals to select the best papers for publication and helps busy scientists to prioritize the scientific literature while providing some quality control. However, the stakes for having one's manuscript published in the relatively short list of selective and elite journals have become high, as decisions for hiring, promotion, and funding have become heavily reliant on publication record. One of the fascinating aspects of the sociology of science is that scientists prefer to publish in journals that present the greatest hurdles, which translate into scientific prestige. Whether based upon impact factor, reputation, or expertise, etc., the venue chosen for publication can have a significant impact in the visibility of a study and the fortunes of the authors. Hence, the most desirable venues for scientific publication are those in which articles are rigorously peer reviewed and editors routinely reject manuscripts on the basis of priority, an imprecise term that is meant to convey importance, preference, suitability, and interest to the readership. The prestige of a journal has become a surrogate measure for the quality of the work itself.

The current system persists despite abundant evidence of imperfections in the peer review process (19, 25). Most scientists would agree that peer review improves manuscripts and prevents some errors in publication (13). However, although there is widespread consensus among scientists that peer review is a good thing, there are remarkably little data that the system works as intended (2, 20, 28). In fact, studies of peer review have identified numerous problems, including confirmatory bias, bias against negative results, favoritism for established investigators in a given field, address bias, gender bias, and ideological orientation (reviewed in references 2, 13, 17, and 31). Smith wrote that peer review is "slow, expensive, ineffective, something of a lottery, prone to bias and abuse, and hopeless at spotting errors and fraud" (28). Chance has been shown to play an important role in determining the outcome of peer review (8), and agreement between reviewers is disconcertingly low (25). Bauer has noted that as a field matures, "knowledge monopolies" and "research cartels," which fiercely protect their domains, suppress minority opinions, and curtail publication and funding of unorthodox viewpoints, are established (3). In response, experienced authors learn

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to negotiate reviewer hurdles by embracing conservatism and avoiding speculation, although some have complained that this response has the effect of "dumbing down" the scientific literature (14). Journals continue to experiment with alternative peer review models to remedy perceived shortcomings: *PNAS* has three separate tracks for manuscript submission, *Nature* recently undertook a brief trial of open review, and the elimination of reviewer anonymity has been discussed extensively (20). The journal *PLoS ONE* reviews manuscripts for methodological soundness but not for perceived significance to the field, a judgment that is left to the readers. *PLoS ONE* also provides readers the option of rating the papers and appending comments (15). Recently, the *EMBO Journal* created a transparent editorial process where all communications to and from the editors along with the text of reviews are available for the reader (http://www.nature.com/emboj/about/process.html). Although each of these models has potential advantages, no model that is clearly superior to the current system has yet emerged. Returning to the questions of censorship, it is self-evident how foibles in peer review can create a major problem with scientific acceptance, for peer reviewers are the major gatekeepers for the printed word (17).

Proponents of human immunodeficiency virus denial or intelligent design like to compare scientific peer review to censorship (7, 11, 29). But the truth is that the scientific community has provided ample opportunity for these ideas to be publicly aired, arguably more than they deserve, and ultimately rejected. That is not censorship. Misrepresenting these discredited ideas as victims of censorship risks minimizing the true threats of scientific censorship, as when a government deletes politically sensitive remarks by scientific agency heads (24) and surgeon generals (16), alters reports by government scientists (21), or prohibits the publication of sensitive data (26).

Publishing in peer-reviewed journals remains the major mechanism for the dissemination of scientific knowledge. The peer review of scientific manuscripts is clearly distinct from these examples of censorship. However, if reviewers prevent authors from any discussion of controversial or speculative viewpoints or if editors are overzealous in screening manuscripts for perceived newsworthiness or consistency with prevailing dogma, there is a danger of blurring the distinction between peer review and censorship. If a reviewer obstructs the publication of a manuscript because it competes with or questions his or her own work, there is an ethical dimension as well. As editors of *Infection and Immunity*, we are often privy to a kind of grammatical "courtship ritual" as authors attempt to maneuver their views past the intellectual hurdles imposed by reviewers. The analogy to a courtship ritual is fitting if one considers that a successful ritual results in the birth of a scientific paper. The typical struggle involves disagreements over significance, with major battles centering on words like "indicates," "suggests," "demonstrates," "is consistent with," "establishes," and "proposes." The complexity of the English language, with its 500,000-plus words, provides a rich resource for compromise. However, the effort spent in linguistic negotiations raises the questions of whether such effort is necessary and might even represent a subtle form of censorship. Reviewers should not try to rewrite papers to fit their own biases. It is one thing to insist that conclusions are supported by evidence. However, some latitude is appropriately given to authors for extrapolation and even speculation. Even more importantly, excessive influence by reviewers can stifle legitimate scientific debate and encourage conformity (18).

Peer review is very different from censorship, but we need to be careful to maintain the distinction. A respect for the wisdom of age requires us to give Galileo the final word here: "Long experience has taught me this about the status of mankind with regard to matters requiring thought: the less people know and understand about them, the more positively they attempt to argue concerning them, while on the other hand to know and understand a multitude of things renders men cautious in passing judgment upon anything new" (12).

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