HOW TO REVIEW A PAPER

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Most scientists acquire their training in manuscript review not through instruction but by actually doing it. Formal training in manuscript analysis is rarely, if ever, provided. Editors usually choose reviewers because of expertise in a given subject area and availability. If an individual repeatedly submits bad reviews, it is likely that that person will not be asked to review a manuscript again. Being invited to review a manuscript is an honor, not only because you are being recognized for your eminence in a particular area of research but also because of the responsibility and service you provide to the journal and scientific community. The purpose of this article is to define how best to peer review an article. We will stipulate several principles of peer review and discuss some of the main elements of a good manuscript review, the basic responsibilities of a reviewer, and the rewards and responsibilities that accompany this process. Proper reviewer conduct is essential for making the peer review process valuable and the journal trustworthy.

ADV PHYSIOL EDUC 27: 47–52, 2003;
10.1152/advan.00057.2002.

Key words: publications; ethics; peer review; reviewer responsibilities

Like any skill, the art of reviewing manuscripts is one that improves with practice. Although a person is not born with the knowledge or ability of how to be a good reviewer, the characteristics (e.g., fairness, thoroughness, integrity) of that person certainly contribute to the activity. Unfortunately, it is rare to find a scientist whose formal training has incorporated instruction in the art of reviewing. Nonetheless, the techniques of peer reviewing a manuscript can be nurtured and developed. Yet, peer review is a recognized and critical component of the overall publication process that confers "added value" to a submitted paper. Moreover, editors are dependent on the identification of a cadre of "good" reviewers that they can rely on for quality control and process efficiency. Reviewers, for the most part, act in this capacity from a sense of duty, selflessness, and a desire to contribute in an important way to the maintenance of high standards and veracity in their specific areas of research. Usually, no monetary compensation is, or should be, provided.

This article will serve as an introduction to peer review. Our intent is to identify issues and ethics of the review process, not to provide a comprehensive set of guidelines for all aspects of the review process. We will focus on the peer review of research manuscripts submitted to scientific journals, but many of the elements of peer review can be applied to other areas, such as grants and books. Several questions will be addressed. What constitutes a good review and reviewer? How should the review of a manuscript be approached? What elements of a review are most useful to the authors and editors? Should a manuscript be reviewed differently depending on the nature of the journal? It is our contention, based on experience,

that if a reviewer acts as an "author advocate," then many potential problems that may arise during the peer review process will be avoided. For example, a reviewer should treat a manuscript being reviewed as he/she would want his/her own paper treated, i.e., provide a critique that is positive, critical yet objective, and balanced, contains no personally offensive comments, and is returned promptly. When specific criticisms are made, the reviewer should indicate precisely what the problems are and how they may be overcome. A confusing or uninformative critique is not helpful either to the authors or to the editor. If the reviewer disputes a point made by the authors, he/she should provide explicit justification for his/her argument (e.g., literature citations). Unjustified biases on the part of the reviewer have no place in peer review. A reviewer also has a responsibility to familiarize him/herself with all aspects of the manuscript unless directed by the editor to focus on a specific area. This may entail reading previous, related articles from the authors or other papers in the field. It is fair to assume that the authors of the submitted manuscript are passionate about their work and that they have made a legitimate effort to perform and interpret their experiments carefully. However, the other hat that a reviewer must wear is that of the "journal advocate." As a journal advocate, the reviewer's job is to make sure that the best possible science appears in print. The purpose of peer review is to ensure *1*) quality, checking that no mistakes in procedure or logic have been made; *2*) that the results presented support the conclusion drawn; *3*) that no errors in citations to previous work have been made; *4*) that all human and animal protocols conducted follow proper review and approval by appropriate institutional review committees; and, very importantly, *5*) that the work is original and significant.

ELEMENTS OF MANUSCRIPT REVIEW

Manuscript review can be divided into two main categories: the technical and the ethical. Both aspects are primarily concerned with making the manuscript better and ensuring that it is reporting trustworthy data. An example of reviewer instructions is presented as Table 1. Note that *points 1, 2, 4, 5,* and *6* are concerned with more technical issues. Is the writing clear, concise, and intelligible? Is the manuscript logical? Does it make a significant and novel contribution to the field? Are there any fatal methodological flaws? Are all the figures clear and necessary? *Point 3* deals primarily with ethical issues. Are there any concerns with regard to the proper use and care of animals? If human studies were done, were they conducted with the prior approval of the subjects and institutions? Did the human protocols conform to prevailing ethical and legal standards? *Point 7* likewise falls under an ethical realm, only not for the authors but for the reviewer. The manuscript must be treated in a confidential manner. Thus a reviewer must not only provide an unbiased evaluative analysis of the structural components of a manuscript but must do so in an acceptable, ethical context.

REVIEWER'S ETIQUETTE AND RESPONSIBILITIES

It is important to remember that a reviewer is asked to provide an informed opinion about a manuscript. The decision whether the manuscript will be published is made solely by the editor. Thus the editor must be able to discern very precisely the reviewer's thoughts and weigh that opinion with or against those of the other reviewers and his/her own. An editor will appreciate a substantive evaluation of a manuscript. If a reviewer disagrees with the conclusion of an author, it is incumbent upon the reviewer to provide definitive reasons or appropriate citations, not simply make remarks such as, "I just don't believe your data," or "It can't possibly be so." If a reviewer has a bias against the author, he/she should recuse him/herself from reviewing the paper. A reviewer must be knowledgeable about the topic and have a clear understanding of the historical context in which the work was done. Because many manuscripts nowadays are collaborative efforts between different laboratories using a myriad of different techniques, it is unlikely that any single reviewer will be expert in all of the protocols encountered in a given paper. The reviewer should comment only on those aspects of the work with which he/she has familiarity; making the editor aware of this is helpful. Again, let us reiterate, the most important rule is to follow the golden rule: treat all manuscripts in the same manner that you would want your own treated.

The responsibilities of a reviewer can be summarized as follows.

TABLE 1
Criteria for manuscript review

1. Scientific quality of the work
   - Are the methods appropriate and presented in sufficient detail to allow the results to be repeated?
   - Are the data adequate to support the conclusions?
2. Presentations
   - Writing: Is it clear, concise, and in good English?
   - Title: Is it specific and does it reflect the content of the manuscript?
   - Abstract: Is it brief and does it indicate the purpose of the work, what was done, what was found, and the significance?
   - Figures: Are they justified? Are they sharp, with lettering proportionate to the size of the figure? Are there legends to explain the figures?
   - Tables: Can they be simplified or condensed? Should any be omitted?
   - Trade names, abbreviations, symbols: Are these misused?
3. Research violations
   - Are there violations of the Guiding Principles in the Care and Use of Laboratory Animals?
   - If the research involved human subjects, were the studies performed in accordance with the Declaration of Helsinki?

If you have concerns about the welfare of animal or human subjects used by the authors, include written comments to the editor.

4. Rating
   - Assign a rating on the reviewer form; rank the manuscript relative to other work in the same field.
5. Confidential comments
   - Provide comments regarding the novelty and significance of the manuscript.
   - Provide a recommendation about the manuscript's suitability for publication in the journal; these comments will not be returned to the author(s).
6. Comments for authors
   - On the reviewer form, provide specific comments, preferably numbered, on the design, presentation of data, results, and discussion. DO NOT include recommendations for publication on the second page.
   - Please be certain that your comments to the author(s) are consistent with your rating recommendation.
7. Privileged document
   - This manuscript is a privileged communication; the data and findings are the exclusive property of the author(s) and should not be disclosed to others who might use this information in their research.
   - The manuscript, illustrations, and tables should be destroyed upon completing the review or, if anticipating a revision, kept confidential until the review process is complete.
   - If you have shared responsibility for the review of this manuscript with a colleague, please provide that person's name and institutional affiliation.

1. The reviewer should provide an honest, critical assessment of the research. The reviewer's job is to analyze the strengths and weaknesses of the research, provide suggestions for improvement, and clearly state what must be done to raise the level of enthusiasm for the work. The reviewer should not manipulate the process to force the authors to address issues interesting or important to the reviewer but peripheral to the objective(s) of the study.

2. The reviewer should maintain confidentiality about the existence and substance of the manuscript. It is not appropriate to share the manuscript or to discuss it in detail with others or even to reveal the existence of the submission before publication. There are some exceptions, if approved by the editor. One exception is that the reviewer may want a junior colleague to have the experience of reviewing and therefore may ask him/her to collaborate on a review. However, if this is done, your collaborator on the review should also agree to maintain confidentiality, and the editor should be informed of the participation of this additional person. Some journals require editor approval before a colleague or student is asked to view a submitted paper; others do not.

3. The reviewer must not participate in plagiarism. It is obviously a very serious transgression to take data or novel concepts from a paper to advance your own work before the manuscript is published.

4. The reviewer should always avoid, or disclose, any conflicts of interest. For example, the re-

viewer should decline to review a manuscript on a subject in which he/she is involved in a contentious dispute and does not feel that a fair review can be provided. The reviewer should also avoid biases that influence the scientific basis for a review. One example of this is a bias that favors studies with positive rather than negative results. Another example is if the reviewer has a close personal or professional relationship with one or more of the authors such that his/her objectivity would be compromised. Scientific merit should be the basis for all reviews.

5. The reviewer should accept manuscripts for review only in his/her areas of expertise. Although editors try very hard to match manuscripts with the most expert reviewers, sometimes mistakes are made. It is unfair to the authors and to the overall review process if the referee does not have the expertise to review the manuscript adequately. The exception to this general rule is when an editor specifically asks for your view as a "nonexpert" or seeks your opinion on a special aspect of the manuscript (e.g., statistics).

6. The reviewer should agree to review only those manuscripts that can be completed on time. Sometimes, unforeseen circumstances arise that preclude a reviewer from meeting a deadline, but in these instances the reviewer should immediately contact the editor. It is unfair to the authors of the manuscript for reviews to be inordinately delayed by tardy referees. Delaying a review can sometimes lead to charges by the authors that the reviewers (who undoubtedly work in the same area) are "stonewallng" in order to publish their related work first, thus establishing priority.

7. The reviewer also has the unpleasant responsibility of reporting suspected duplicate publication, fraud, plagiarism, or ethical concerns about the use of animals or humans in the research being reported.

8. The reviewer should write reviews in a collegial, constructive manner. This is especially helpful to new investigators. There is nothing more discouraging to a new investigator (or even to a more seasoned one) than to receive a sarcastic, destructive review. Editors are not trying to determine the scientific prowess or wittiness of the reviewer. The reviewer should not shy away from discussing the weaknesses (or strengths) of a study, however. No one likes to have a paper rejected, but a carefully worded review with appropriate suggestions for revision can be very helpful. In fact, an author should prefer to have his/her paper rejected if the review process uncovered errors in the study.

SUMMARY

Reviewing is both a privilege and responsibility. It takes time to prepare a useful, critical review. Moreover, it clearly is a service to the journal, to the authors, to science at large, and to the reviewer because the reviewer becomes privy to the latest in cutting-edge research. Most journals do not pay referees, although most do provide acknowledgement in print to the editorial board and external referees in each issue of the journal and/or, like the American Physiological Society, by holding a yearly Publications Banquet at the Experimental Biology meeting. Peer review is the heart and soul of scientific publishing. Editors rely on reviewers to assess quality and to determine which of the many manuscripts competing for space will be published. Therefore, the most important reward for you as a reviewer is your contribution to the quality of published science.

We submit that, regardless of the perceived preeminence of any particular journal, you should approach the review of each research paper the same way. Table 2 provides a checklist for the essential elements that should be addressed in any review. Table 3 summarizes what a handling editor is concerned with when evaluating the quality of a review and reviewer.

TABLE 2
Checklist for reviews: issues for comment

1. Importance of research question
2. Originality of work
3. Delineation of strengths and weaknesses of methodology/experimental/statistical approach/interpretation of results
4. Writing style and figure/table presentation
5. Ethical concerns (animal/human)

TABLE 3
Editor's evaluation of review and reviewer

1. Thoroughness and comprehensiveness
2. Timeliness
3. Citing appropriate evidence to support comments made to author
4. Providing constructive criticism
5. Objectivity
6. Clear statement to editor as to the appropriateness and priority of research for publication

From a practical point of view, publishing your own manuscripts depends on the quality and altruism of other peer reviewers, and you undoubtedly desire your own work to be evaluated carefully and fairly. There are many aspects of providing good constructive reviews. Some of these are best learned through your mentors and your own experience. However, the most important traits are courtesy, fairness, and punctuality. Thus, when peer reviewing, follow the golden rule: treat other manuscripts as you would want your own to be treated. The entire peer review process, which in essence determines the public record of science, is based on trust—trust between authors and editors and trust between editors and reviewers. The quality and integrity of the entire scientific publishing enterprise depends in large measure on the quality and integrity of the reviewers.

RESOURCES

Very little definitive research into the practice and effectiveness of peer review has been done, although groups such as the Council of Science Editors, the American Medical Association, the American Chemical Society, the American College of Emergency Physicians, and the Committee on Publication Ethics recognize the importance of such information. For example, the *Journal of the American Medical Association* has sponsored four International Congresses on Peer Review in Biomedical Publications (10). The September 2001 issue of *Academic Medicine* was dedicated to a discussion of review criteria and reviewer behavior for research manuscripts (5). A book summarizing the latest research on different aspects of peer review has been published by the *British Medical Journal* (4). A number of general articles on peer review and the role of a reviewer have been published (2, 6, 7, 9). Several articles concerning reviewer selection criteria and evaluation also exist (1, 3, 8).

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We thank Margaret Reich for helpful discussions and comments on the manuscript.

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Received 11 December 2002; accepted in final form 20 March 2003

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