

Ethics of Peer Review: A Guide for Manuscript Reviewers

Sara Rockwell, Ph.D.

Departments of Therapeutic Radiology and Pharmacology, and Office of Scientific Affairs,
Yale University School of Medicine, PO Box 208040, New Haven, CT 06510-8040

Abstract

The peer review of scientific manuscripts is a cornerstone of modern science and medicine. Peer reviewed journals rely on expert and objective review by knowledgeable researchers to ensure the quality of the papers they publish. Moreover, the recommendations the reviewers make concerning publication and the advice they give to authors set the scientific standards of the discipline. In addition, their critiques set subtler standards of collegiality, behavior, and ethics, not only through their recommendations concerning which papers should be published and which should be rejected, but also through the tone and wording of their reviews and through the thought that they give to their scientific and ethical responsibilities as reviewers. The review of manuscripts for peer reviewed journals raises many ethical issues and problems. The reviewer should be aware of these when deciding whether to review a specific paper, throughout the process of handling the manuscript and writing the review, and even after the review is completed and submitted. This paper describes some of the ethical issues that can arise during the peer review process and discusses their implications.

INTRODUCTION

The peer review of scientific manuscripts is a cornerstone of modern science and medicine. Peer reviewed journals rely on expert and objective review by knowledgeable researchers to ensure the quality of the papers they publish. Moreover, the collective activities of the investigators who review manuscripts in a scientific discipline serve to set the standards of that field. This body of unpaid, and often unidentified, volunteers offers a collective opinion on the expected standards of scientific rigor for the discipline. Their opinions on such matters as which techniques are current, valid and appropriate; how data should be analyzed and presented; and how rigorous authors must be or how speculative they can be in the interpreting their data become *de facto* standards of the field. In addition, their critiques set subtler standards of collegiality, behavior, and ethics - not only through their recommendations concerning which papers should be published and which should be rejected, but also through the tone and wording of their reviews and through the thought that they give to their scientific and ethical responsibilities as reviewers.

For most young investigators, their first experience with the peer review system comes when they submit their first manuscript for publication and receive their first critiques and editorial decision. The process is a “black box” - journals and mentors alike generally provide few insights into the workings of the peer review process or into the reasoning of the reviewers.

A young researcher’s first experience as a reviewer is often just as haphazard: he or she is suddenly given a manuscript to review. Fortunate young researchers are asked by their advisor or mentor to review a manuscript and are offered assistance. Many, however, are suddenly thrown into the process when a journal sends them a paper to be reviewed. All too often, new reviewers are given little guidance as they approach this task. The journal may send a set of instructions to reviewers that provides information on such specifics as the format for the review and the date when the journal wants the review, but there is often little guidance on the overall review process or on the related ethical issues the reviewer should be considering. This paper considers and discusses some of these ethical issues. As we will see, they can be vexing, and some issues are complex and may offer no clear right or wrong pathway to follow.

THE PEER REVIEW PROCESS – A GLIMPSE BEHIND THE SCENES

To be a good reviewer, one must understand the peer review process and the role the reviewer is expected to play in that process. Most scholarly journals, whether they are not-for-profit journals owned by professional societies or for-profit journals owned by a publishing company, are backed by a professional staff that manages the “business” of publishing. This staff oversees the receipt of manuscripts, manages communications with authors and reviewers, and processes accepted manuscripts for publication. These staff members generally are not scientists, although many develop an excellent working knowledge of the science in the area of their journals. Each journal also has one or more scientific editors who make the final decision as to whether a specific manuscript will be accepted for publication, returned to the author for revisions, or rejected. These editors are usually researchers with deep expertise in the area of the journal. These senior editors are often assisted by an editorial board; the members of this board are drawn from the research community served by the journal and have been selected for their expertise and skills. Members of the editorial board read the manuscripts they handle for the journal and they

may prepare and provide critiques. They often select additional reviewers, solicit reviews from them, and monitor the quality of the reviews. The editorial board members make recommendations to the senior editor concerning publication of the manuscripts. While the authors generally communicate with the non-scientists who staff the journal office, the scientific editors work behind the scenes to oversee the scientific and intellectual quality of the peer review process.

How do these editors find reviewers? They use all the tools and grapevines at their disposal. They usually will consider, and sometimes will request, suggestions for reviewers from authors. They may examine the references cited in submitted manuscripts to identify researchers working in related areas. They may perform literature searches looking for related papers or may consider authors who have submitted solid papers in related areas to the journal. They may recall people they have heard give good seminars or good talks or posters at meetings. They use their networks of colleagues and people they know from scientific meetings, study sections, and professional societies. They often keep files of past reviewers, sometimes with data that provide information on the expertise of these reviewers, the timeliness of receiving their reviews, and the quality of their comments. They also ask reviewers they know and trust for names of potential new reviewers.

What do the editors look for in reviewers? Expertise in one or more aspects of the work is of course essential, but the qualities of a good reviewer go well beyond that. The reviewer must be objective and must not have conflicts of interest that might compromise the objectivity or perceived value of the review. He or she must have good judgment and must be able to think critically and logically. The reviewer must be able to write a good critique that is accurate, readable and helpful to both the editors and the author. The reviewer must be reliable and must have the time to do the task, and do it well, in the time frame allotted. There are many solid researchers, with deep scientific expertise, whose performance as reviewers is disappointing.

The advent of electronic communication has changed the review process greatly. A decade ago, journals usually mailed manuscripts to reviewers without contacting them in advance. Today, most editorial offices contact potential reviewers by e-mail, or decreasingly by fax or telephone, to ask whether they can review manuscripts. The authors, title, and abstract are generally provided so that the reviewer has an overview of the paper. After the reviewer has agreed to review the paper, he/she receives the full manuscript, generally by e-mail or through a website, along with review forms, information on the journal's policies, and procedures for reviews.

The review is generally submitted electronically (by e-mail or through a website). It generally contains one section for comments that go only to the editor (if any are needed) and another for comments that go to the author. Ancillary materials can also be sent in the rare cases where these are valuable (a copy of the manuscript marked to show specific suggestions or comments; a publication the authors may find helpful).

The identity of the reviewer will be known to the editors, but most journals do not release the names of the reviewers to the authors, the other reviewers or third parties. The blinding of reviews is intended to protect the reviewers and to allow them to provide critical and honest reviews. However, the reviewer should remember that no system is perfect. Authors will

sometimes identify a reviewer because of an error by the journal office or editors, because the reviewer inadvertently discloses his/her identity in the reviews, or by deducing the reviewer's identity from the comments and suggestions in the review or even by the writing style. The possibility of identification by the author and the availability of the reviewer's identity to the editors are among the reasons why reviewers should take care to provide constructive critiques, written in a collegial manner, rather than using their anonymity as a cloak to allow snide or rude comments and argumentative critiques.

After receiving the reviews and the recommendation of the editorial board member, the editor makes a decision concerning publication. This is sent to the authors along with copies of the "comments to authors" sections of the reviews. These may be edited if the editors feel this is necessary. Many journals send reviewers information on the outcome of the review process and some send them copies of the reviews sent to the authors, so they can assess how their reviews compared with those of other reviewers.

SOME ISSUES TO CONSIDER WHEN DECIDING WHETHER TO REVIEW A PAPER

By agreeing to review a paper, the reviewer makes an implicit agreement to become a consultant to the journal and to adhere to the journal's policies and guidelines for the review of manuscripts. The reviewer also incurs responsibility for setting the standards of the field of study. The reviewer must be able to judge fairly and objectively the quality and significance of the work under review. He/she is obligated to support and encourage publication of work of high quality while appropriately challenging flawed work. Before agreeing to review a paper, the reviewer should consider her/his ability to meet these standards.

Do you have the expertise the editor is looking for?

From an editor's point of view the ideal reviewer is a researcher who is working in the same discipline as the subject of the paper yet is not in direct competition with the authors. The ideal reviewer will understand the hypotheses underlying the work and will be familiar with the model systems and methods used in the project. He or she will be able to judge the quality of the data and the analyses and assess the validity of the conclusions. The ideal reviewer will be able to assess the significance of the work to the field.

Many young researchers are reluctant to review manuscripts, because they fear they do not have enough experience or expertise to be good reviewers. Perhaps ironically, surveys show that journal editors often feel that junior researchers generally provide reviews superior to those of senior scientists. This may be in part because younger researchers spend more time, effort, and care on their reviews. Young reviewers tend to underrate their expertise and to forget that they often have more intensive hands-on experience with new techniques and technologies than do their senior colleagues who are no longer at the bench. They also fail to realize that they are only one of 2, 3 or perhaps even more reviewers, each of whom was selected to provide a different area of expertise and a different perspective. For example, an editor looking for reviewers to critique a paper reporting the first phase I clinical trial of a new investigational anticancer drug might seek a physician who has performed clinical trials with patients having the similar tumors,

a laboratory scientist who has performed preclinical studies with the agent, and a statistician who can assess the design of the trial and the analysis of the data. Each of these reviewers will provide expertise in an important area of the paper and each will find areas in which he/she lacks expertise and cannot provide assistance. If in doubt, the potential reviewer should contact the editor and discuss his/her concerns. This allows the editor to decide if the reviewer does have the expertise he/she is seeking, and also allows the editor to add an additional reviewer if there is an area that requires expert review and is not covered by the first set of reviewers. During the review process, reviewers often find that they have questions or concerns about an area outside their expertise (e.g. questions concerning the statistical analyses); this is not a problem. Review forms have a section for comments to the editors, where the recommendation for additional reviews can be stated, so that the editor can assess whether they have been addressed by one of the other reviewers or whether an additional review is needed.

Is the work *too* close to your own?

Sometimes a potential reviewer is presented with a very awkward problem when he/she is asked to review a paper that is very close to his/her own work. As will be discussed below, manuscripts under review are considered confidential documents. By agreeing to review a manuscript, the reviewer assumes an obligation to keep the data in confidence and not to use it for his/her own benefit. This can raise a problem when a reviewer receives a request to review a paper which reports experiments that overlap with studies that the reviewer is already performing, planning to perform, or preparing for publication.

The potential reviewer should not review this paper: doing so presents a “no-win” situation even if the reviewer acts with the utmost integrity. If the paper is good and the reviewer were to review it rapidly and recommend acceptance, he/she might well compromise his/her ability to publish his/her own work – this knowledge creates an immediate, significant conflict of interest. On the other hand, if the paper proves to be flawed and the reviewer (with all integrity) were to recommend extensive revisions or rejection, the perception of misconduct could arise in the editor’s mind when the reviewer’s own studies were submitted or published.

The reviewer is therefore in an unfortunate situation in which even totally ethical actions could produce unpleasant outcomes, and should take immediate steps to minimize the potential for adverse effects. The potential reviewer should contact the editor immediately, inform the editor of the problem, and decline to review the paper. If at all possible, this should be done when the reviewer has seen only the title and abstract; the reviewer should make every effort to ensure that he/she does not receive the complete paper. The procedures now being used for electronic reviews are helpful in this regard – but there is still a possibility that a colleague or an editor will give a potential reviewer a complete manuscript along with a request for a review, in which case an immediate discussion of the problem and return of the manuscript are essential.

Do you have any *real* or *apparent* conflicts of interest?

This is an issue that the reviewer must consider carefully. Most journals have policies that require that potential reviewers recuse themselves from reviewing manuscripts if they have a real

or apparent conflict of interest that might compromise the objectivity of the review or that might appear to compromise its objectivity. Editors attempt to avoid selecting reviewers with obvious conflicts of interest but mistakes do happen: most seasoned reviewers have at some point been asked to review a paper on which they were a co-author or in which they were thanked for their help with the paper or the project. These conflicts can be readily identified by the potential reviewer and are easily resolved by declining to review the paper. Other conflicts may be less obvious or more difficult to handle.

The ethical standards, rules, and regulations concerning conflicts of interest are evolving and changing. Different journals and different organizations have markedly different standards for determining when a conflict of interest has reached the level of “significance” where it presents a problem. The reviewer therefore will not have the comfort of having definitive, universal guidelines that provide clear “yes” or “no” answers, but instead must consider each situation carefully and assess whether there is a potential conflict of interest that a) would or could compromise his/her objectivity and judgment, b) would or could *appear* to compromise his/her objectivity and judgment, and therefore compromise the value of the review, or c) would or could *appear* to compromise his/her objectivity and might place his/her reputation at risk if this conflict were discovered and questioned after the review. Potential reviewers are therefore put into the somewhat disconcerting position of having to analyze not only their own biases and conflicts of interest but also problems that could result from assumptions of bias made on the basis of *the appearance of* a possible conflict of interest. There are two prudent rules of thumb: 1) when in doubt, discuss the potential conflict of interest with the editor and 2) when in doubt, err on the side of caution.

Institutional affiliations: Are any of the authors from your institution? If so, you should not review the paper. Even if you do not know the person and could be totally objective, there are perceptions that could create problems. Someone may assume that you do know the authors or should know them because their work is close enough to your own that you have been asked to review it. The possibility of pressure will also be perceived: are there senior faculty at your institution who could/would pressure you to report in favor of publication if they knew you were the reviewer or who might retaliate if they later found you had written an unfavorable review? Others may think this could occur even if you dismiss the possibility.

Other institutional affiliations may create more subtle conflicts of interest. Are you negotiating for a job at the author’s institution? Did you just leave that institution? Are you a consultant to a grant, contract, or program that supports the author or the author’s department? Are there other hidden conflicts? For example, does your sister work in the author’s department? If the authors are from a pharmaceutical or a biotech company, does that company fund any of your research or support it by providing free compounds or reagents? Do the authors or their institution control access to a critical and difficult-to-obtain reagent that you use or are trying to obtain for use in your own research? The reviewer sometimes will be the only person able to identify and think about such potential conflicts of interest.

Collaborators and colleagues: Is any author of the paper a present collaborator, your mentor, or someone you have collaborated with or published with in the past? Ongoing collaborations raise both real and apparent conflicts of interest. You should decline to review the papers that list your

present collaborators as authors. In general, you should not review papers written by people you have collaborated with or published with in the recent past. Beyond this there is a gray area, where you will need to assess whether you can be objective and can be perceived as objective. As your career progresses you will accumulate co-authors of past papers – some of whom are linked to you only through a common collaborator and some of whom you will never have met. When the papers are old enough and the connections tenuous enough, the real and apparent conflicts of interest can become insignificant. Such associations need to be considered on a case-by-case basis. Remember, however, that although the problems raised by *apparent* conflicts of interest are different from those raised by *actual* conflicts of interest that truly cloud one's judgment, the problems they raise are real and merit thoughtful consideration. If in doubt, contact the editor, disclose and discuss the potential conflict of interest, and seek guidance on whether to perform the review.

Other relationships: Institutional affiliations and collaborations are not the only relationships that may create conflicts of interest. Other relationships, which may be more difficult for the editors to discern, can also be important. Papers from close personal friends or family members present obvious conflicts. So do papers from people you detest; declining such papers without making negative comments about the person can present a challenge in diplomacy. A junior researcher may feel uncomfortable reviewing a paper from a very senior member of the field, because he/she would feel uncomfortable about giving a negative review to this influential person. You should think about this in advance. What if the paper is truly awful? Would you be willing and able to give it the review it deserved?

Financial conflicts of interest: Problems with financial conflicts of interest have recently received considerable attention, not only in the scientific community but also in Congress, the courts, and the popular press. Some financial relationships create obvious conflicts of interest, but there is a large gray area where the impact and importance of such conflicts are being actively debated. Different agencies and different journals have very different definitions of the level at which financial conflicts rise to a level where they are “significant” and must be disclosed and managed or where they would preclude performing the review.

The most obvious financial conflicts of interest involve research related to a product or process that is owned or marketed by a for-profit entity. Examples receiving recent media attention have included phase III clinical trials in which the efficacies or toxicities of drugs are being evaluated and phase I studies of potential gene therapy agents. In some cases, many different companies might be involved, e.g. in studies of the effects of smoking, alcohol consumption, cell phones, or general classes of drugs (e.g. Cox 2 inhibitors or specific classes of psychoactive medications). In the latter case the reviewer's financial relationships with any of the companies involved may need to be considered.

Financial conflicts of interest can take many forms. A potential reviewer who works for the company that owns the product being tested has an obvious conflict of interest. However, a university faculty member who is consulting or has consulted for the company may also have a conflict, depending on the nature of the consulting relationship and the magnitude of the financial rewards. A medical consultant who received a \$50,000 for providing opinions on the commercial value of a specific drug would almost certainly be considered conflicted and unable

to review papers on that drug. In contrast a researcher who served in an unrelated clinical trial as a member of the data and safety monitoring board (the members of which are chosen to provide impartial oversight of the welfare of the subjects) or a scientist who served previously on a scientific advisory board for a different agent and received a token honorarium may not be viewed as having significant conflicts. Fiduciary responsibilities (e.g. membership on the company's board of directors; service as an officer of the company), even without compensation, present conflicts of interest because they are accompanied by inherent obligations to work for the success the company. Patent agreements and licensing agreements between the potential reviewer and the company likewise create an arrangement for mutual financial benefit and therefore a conflict of interest.

Receiving funding (grants, contracts, or gifts) for research projects or clinical trials from the company whose product is being examined presents obvious conflicts of interest. Even if direct funding is not provided, conflicts of interest can arise from other relationships. For example, a company may provide, at no cost, expensive or hard-to-obtain drugs or reagents for use in research and therefore provide critical non-monetary support for a research project.

Alternatively, a potential reviewer may hold equity (stock or stock options) in a company. There is significant debate as to how large such holdings must be to represent a significant conflict. Ownership of very large amounts of equity or stock in a small startup company whose value would be changed dramatically by the success or failure of a single product presents obvious conflicts. A small stock holding in a very large, established, publicly traded company presents a less clear cut conflict, as the reviewer's actions would be unlikely to impact the value of the holding. Nevertheless, some journals would consider this to be an unacceptable conflict. Investments held as part of mutual funds or in retirement accounts such as TIAA/CREF are generally considered insignificant because the portfolios of the accounts are highly diversified, are managed by investment managers, and are not under the control of the participants.

Conflicts of interest can reach beyond the income and holdings of the reviewer: the employment, income and investments of the reviewer's spouse, partner or dependent children are also viewed as relevant in considering conflicts of interest. There is also increasing concern about "institutional conflicts of interest." These could arise, for example, when a University has financial or research affiliations with a commercial entity that are sufficiently robust that they raise the question of whether the institution's conflicts of interest compromise or appear to compromise the ability of its staff and faculty to act with absolute objectivity. This could also apply on a more local level: e.g. a young investigator who does not have significant conflicts of interest of his/her own but who is working in the laboratory of a senior investigator with significant conflicts of interest related to the review may be considered to be conflicted.

The reviewer must also remember that issues of conflict of interest can extend well beyond connections to a specific commercial enterprise, to include relationships with other companies that could potentially benefit or be harmed by the reviewer's actions. Thus, a relationship with a company marketing a technology competing with that being tested in the paper could pose a conflict of interest. Alternatively, an individual who has spoken or testified frequently either for or against new restrictions on smoking in public places could be viewed as having a conflict that would preclude reviewing a paper on the effects of exposure to secondhand smoke.

Personal beliefs. A strongly held personal belief or a vocal public position in a scientific argument could raise problems if it compromises or appears to compromise the objectivity of a review. For example, a strong religious belief excluding the possibility of evolution could present a problem in the review of a paper describing a fossil presented as being important to the development of *Homo sapiens*. Other emotionally charged topics (e.g. human stem cells, abortion, marriage laws) may raise similar problems if the reviewer's ability to provide an objective review is or may appear to be compromised by strongly held views. Even in issues of pure science (e.g. a heated debate over the validity of a specific scientific method or an observation), emotions can occasionally rise to a level where objectivity can be, or appear to be, compromised.

Scientific conflicts of interest. Last, we should return to the issue of scientific conflicts of interests, discussed above. A researcher whose work is too closely related to the work presented in the paper may well have a conflict of interest which precludes her/him from reviewing the manuscript. Similarly if the researcher's laboratory and the authors' laboratory have been actively competing in a general area of research, there may be an apparent conflict of interest, and the researcher would be wise to decline to review.

The issues related to conflicts of interest in peer review, as in other areas of research, are complex. There has been increased sensitivity, and sometimes hypersensitivity, to these issues in recent years. The threshold at which a conflict of interest is viewed as "significant" varies from agency to agency and journal to journal. Some have announced "zero tolerance" policies; others set very high thresholds for "significance." While it might seem that science would be best served by completely avoiding all potential conflicts of interest during the peer review process, rigorous implementation of this standard would also have negative effects. It could, for example, in some cases preclude all those who have been involved in preclinical studies or clinical trials with a new agent from reviewing all future papers on that agent. Similarly, it could preclude many of those who have deep experience using an existing drug to treat a disease from reviewing papers reporting on new (competing) compounds that are being developed to treat the same disease. Journals and reviewers therefore must strive to ensure that both appropriate expertise and appropriate objectivity are brought into the review process.

Do you have the time to review the article within the time frame requested by the editor?

Most journals request that reviewers read and critique manuscripts within a relatively short time. The exact time frame varies with the journal and the category of paper. In some cases it is as short as 48 hours; it is often 2-3 weeks. It is unfair to both the author and the journal to accept a paper for review if you know you cannot review it rapidly. It is also unethical to give the paper only a cursory reading and then provide a superficial and careless review. In agreeing to review a paper, you are contracting to provide the journal with a thorough and incisive review. The review need not be long: indeed in the case of the very best and very worst papers the written critiques may be very short. However, even these very short reviews require time, reflection, and thought.

Reviewing manuscripts does take time. Most reviewers estimate that they spend 1-2 hours on a typical manuscript review. Some reviews prove difficult, and require much longer. Participation

in the peer review process is one of the unfunded and largely unrewarded tasks that researchers perform because they are “good citizens” of the scientific community. Peer review is critical to maintaining the quality of science; there is therefore an ethical imperative for scientists to participate in this process when they are able to do so. However, even the most conscientious scientist will have times when he or she is simply unable to take on an additional task. In such cases the invited reviewer should decline to review – this is preferable to agreeing to do the review when one cannot do a good job within the required time.

SOME ISSUES TO CONSIDER ONCE YOU HAVE RECEIVED THE PAPER

When most editorial offices contact potential reviewers they provide the authors, title, and abstract so that the reviewer has an overview of the paper. Only after the potential reviewer has agreed to review the paper, does he/she receive the full manuscript. At this point the reviewer will have additional ethical issues to consider.

Does seeing the full manuscript change your thoughts about your ability to review it?

It is not uncommon for new ethical or logistical problems to arise when the potential reviewer sees the actual manuscript. For example, the reviewer may find that the abstract did not describe accurately the contents of the paper and may feel uncomfortable with some areas of the review. The reviewer may also become aware of potential conflicts of interest that were not obvious from the abstract. Again, the basic rule of thumb is to contact the editor as soon as possible to discuss and resolve such problems.

How do you handle the paper?

Manuscripts under review are confidential documents, and should be treated as such. They contain unpublished data and ideas that must be kept confidential. You cannot share the paper or its contents with your colleagues. Manuscripts that you are reviewing should be kept in a secure place, where they will not be readily accessible to the curious or unscrupulous.

Moreover, you cannot use the information in the paper in your own research or cite it in your own publications. This can raise serious ethical issues if the work provides insights or data that could benefit your own thinking and studies. An especially difficult situation is that in which you receive a manuscript which has serious flaws, causing that you recommend rejection or major revisions that will require time and new experiments to address, but also contains an element that you find exciting and would like to explore yourself. Such cases can become ethical quagmires.

The outcome and content of the review are confidential. You should not discuss the review or its outcome with your colleagues. Scientific reputations and egos are fragile, and the release of information concerning a negative review could be injurious. On the other hand, leaking information on your positive review could lead to false expectations if other reviews prove to be unfavorable and the paper is ultimately rejected.

Lapses in the confidentiality undermine the review process, betray the trust of the authors and the editors and can create serious problems for everyone involved in the reviews.

Can you pass the paper on to someone else to review?

This can only be done with the permission of the editor. The cover letters some journals send to senior scientists with requests to review often invite these researchers to suggest names of alternate reviewers or give them permission to assign the manuscript to another person for review. In this case, the reviewer is free to give the paper to a colleague for review – this is often the way that young researchers are initiated into the review process. If such permission is not granted in the cover letter, the editor should be contacted with the request. In my experience, it is unusual for such requests to be denied.

In either case, the reviewer initially contacted by the journal should let the editor know that the manuscript has been given to another reviewer. This information is important for the journal records. With some web-based review systems, access to the paper and review system is granted to specific individuals, and the information will be necessary so that the journal office can configure a web portal for the new reviewer. The journal staff also needs to know the identity of the reviewer so they can follow up if there are questions concerning the review and so that they can send the reviewer any revised manuscripts requiring re-review. This information also allows the journal to contact this reviewer directly for future reviews.

Identifying the reviewer to the editor is also important to the reviewer, especially if she/he is a junior investigator, because it allows her/him to develop a track record in the peer review process. Editors and editorial board members are always on the lookout for good reviewers to add to their reviewer pool. Editors and journals keep files of past reviews and data on their reviewers, often with notes on the timeliness and quality of the review. Journals often thank their reviewers in the printed journal or on the journal or society website. In addition, journal editors and editorial board members are routinely asked for names of potential committee members for professional societies, study section members, and speakers and are frequently asked to comment on proposed promotions. A solid track record of performance in the peer review process will increase the visibility of a young investigator and enhance the development of his/her career. Mentors and mentees therefore should both ensure that young researchers receive appropriate credit for their reviews.

SOME ETHICAL ISSUES TO CONSIDER AS YOU READ AND REVIEW THE PAPER

Can you contact the author about the work or the paper?

You generally cannot contact the author about the manuscript during the review process. Most journals regard the review as a confidential process and wish the authors to remain blinded to the identity of the reviewers and often to the identity of the editorial board member handling the manuscript.

Sometimes a reviewer will need information from the authors (e.g. a copy of a related manuscript which contains data critical to the paper under review but which is still in press or is published in a venue that the reviewer cannot access.) In such cases, the reviewer should contact the journal staff, who will communicate with the reviewer.

In very rare cases, a reviewer may feel that he/she needs to communicate directly with an author about a specific issue in a paper. In these rare cases, the reviewer should contact the editor of the journal and discuss the reasons for the request, the importance and advisability of direct contact between the author and reviewer, and the conditions and time at which such contact would be appropriate.

Can you seek help with your review?

Sometimes a reviewer may wish to seek advice or information from a colleague during the course of a review. In some cases, simple questions can be asked without compromising the confidentiality of the review process. For example, the reviewer could ask a colleague who had extensive experience with a specific cell line (or mouse substrain) whether that cell line (or mouse substrain) had a specific biological characteristic assumed by the author without discussing the paper under review. Similarly, the reviewer could ask a colleague whether a specified statistical technique were appropriate for use with a specific class of data, without discussing the data or the paper.

Before going beyond such anonymized questions, the reviewer should contact the editor. If permission is granted, the reviewer should remember that this consultation is still part of a confidential process: the consultation should be made with appropriate discretion and the consultant also becomes committed to handling the paper and its contents in confidence. The review should note in the comments to the editor that the colleague has seen the paper and assisted with a review. This is important for the journal records and also assures that the colleague gets appropriate credit for her/his contribution to the review.

You are the agent of the journal, not the friend of the author

New reviewers often empathize with the authors of the manuscripts they review. The day-to-day activities of young researchers usually involve collegial interactions within a group of researchers and trainees, where an atmosphere of mutual assistance is dominant. It is sometimes difficult for them to adjust their focus to the more institutional perspective and to realize that their primary role in the review process is to advise the journal, not to assist the author. They must make this shift to be effective reviewers. A reviewer may feel bad about rejecting a paper and empathize with the authors of the paper, but she/he must be able to make such a recommendation when it is the appropriate one.

The reviewer must remember that it is unethical to allow a badly flawed paper to pass unchallenged into the peer reviewed literature, where it will be a trap to the unsophisticated reader who will read the manuscript (or perhaps only the abstract) superficially and will simply accept the flawed conclusions at face value. Articles in peer reviewed journals are trusted by readers who would be skeptical of claims made in non peer reviewed sources. The peer review process is viewed as a process that provides a scientific stamp of approval to the paper and its contents. The reviewer therefore has an obligation to support work of high quality while appropriately challenging flawed papers.

As a reviewer, you are helping to set the standards of the journal and of the field

In making recommendations for acceptance, revision, or rejection of manuscripts, reviewers are helping to set the standards of the journal. Moreover, the collective activities of the investigators who review manuscripts in a scientific discipline set the standards of that field. Their opinions on such matters as which techniques are current, valid and appropriate, how data should be analyzed and presented, and how rigorous authors must be or how speculative authors can be in the interpreting their data, become *de facto* standards for the field.

The reviewer therefore must consider the manuscript from the perspective of the journal and the field of science. This is often the first time that a scientist must work from such a perspective. It probably will not be the last, as similar detached, objective viewpoints will be needed when the investigator begins grading students, reviewing grants, and commenting on proposed promotions.

Reviewers must also be aware of some subtle biases that can influence their judgment and recommendations. For example, many studies have shown a bias by reviewers and editors alike in favor of the publication of papers which present positive findings, rather than negative findings. Thus, a paper reporting a beneficial effect of a new drug in preclinical studies or in a clinical trial is more likely to be published than an equally well performed and well presented study showing that the drug is not effective. In contrast, once a drug is marketed, a clinical trial confirming that the drug is safe and effective in the same or an additional population may be viewed as an uninteresting negative result, and is less likely to be published than a study showing that the drug had an unexpected toxicity. Similarly a paper showing that an environmental pollutant is associated with a toxic effect is more likely to be published than one not showing an effect. This systematic bias in favor of publishing positive results has had unfortunate impacts in many areas in which risk/benefit ratios are considered by scientists, physicians, regulatory agencies, and the public. The reviewer should be prepared to recommend and encourage publication of a well performed study presenting important negative results.

Conversely, papers that challenge existing dogma or that present surprising findings may be dismissed too readily during the review process. Many scientists who have revolutionized their fields with new ideas or new techniques later describe with amusement their difficulty in publishing their first papers on the subject. Papers that purport to break new ground and cause rethinking of previous assumptions, models and data require careful scrutiny during the review process, but the potential importance of such papers makes it important that they be reviewed thoughtfully, carefully, and objectively.

The journal needs your scientific expertise, not your editorial assistance

Journals rely on their reviewers to evaluate the quality, importance, and novelty of the science presented in the manuscript. Perhaps surprisingly, editors frequently receive reviews that focus completely on minor editorial problems (typographical errors, misspellings) and do not comment on the science in the paper. Such reviews have limited value as they do not advise the editor on the value and validity of the science and do not help the editor to make an informed decision concerning publication. If the findings in the paper are not worthy of publication, the detailed

editorial comments are of no value to the journal. If the paper is processed for publication, such errors generally will be found and corrected by the journal staff. There are cases where reviewers should make editorial comments. They should, for example, identify sentences or paragraphs where the wording is sufficiently erroneous or ambiguous that the science is unclear. They should also point out editorial errors that result in scientific misstatements. They should point out errors in referencing. A note to the editor that a manuscript requires major editorial assistance, perhaps because the author is not fluent in English, or a warning that a manuscript is so carelessly prepared that the science cannot be rigorously reviewed is always in order. However, the reviewer should not waste inordinate amounts of time correcting minor problems with spelling, grammar, or punctuation.

Instead the review should focus on the science. The reviewer should consider and comment on a variety of issues, including the importance and novelty of the work; the appropriateness of the materials, methods and experimental model systems; the rigor of the experimental design (including the inclusion of appropriate controls); the quality of the data; the appropriateness of the statistical analyses; the rigor of the interpretation of the data; and the validity of the conclusions drawn in the paper. The reviewer may have comments on the length of the paper, the writing quality; the clarity, accuracy, and completeness of the figures and tables; the accuracy and adequacy of the introduction which frames the area of the research, the discussions of prior and related work, and the citations to the literature. The comments made in the review should present clearly the reviewer's analysis of the quality, novelty, and importance of the science and the effectiveness and appropriateness of its presentation in the manuscript.

You should consider the appropriateness of the paper for the journal

The job a reviewer agrees to perform is to advise the journal on whether the paper he/she has been sent should be published in that journal.

In making this recommendation, the reviewer should consider not only the quality of the work, but also its appropriateness for the specific journal. A journal with a broad reader base, such as *Science* or *Nature*, wants to publish articles of wide general interest, written so that they can be understood and appreciated by scientists in other fields. A specialty journal, such as *Radiation Research* or *Annals of Emergency Medicine*, will be interested in a much narrower range of subjects and will publish some highly specialized papers written for experts in a narrow area. Papers presenting solid science and having high potential impact therefore may be unsuitable for publication in a specific journal simply because of the mismatch between the journal and the paper. The reviewer should therefore consider the focus and needs of the journal as he/she reviews the paper. It is sometimes perfectly appropriate to return a review which states that a paper is of very high quality and worthy of publication but that it is inappropriate for publication in the journal to which it was submitted. In such cases, it may be valuable to the author to suggest a more appropriate journal.

The reviewer must also consider whether the paper meets the standards of the journal. The journal generally will provide some guidance on the points the journal considers critical, and

may ask some specific questions on the review form. Some journals set a higher standard than others; some require more and some want less methodology detail in the papers they publish.

Ethical concerns may arise during a review

During the review of a paper, a reviewer may discover ethical issues that must be considered and addressed. These may be relatively minor problems, which simply require additional information. For example, if the protocols for a study with human subjects seem appropriate, but the methods make no statement that the study had been reviewed by an IRB, the author may only need to add information on the IRB review.

The reviewer may have more serious ethical concerns. He/she may raise ethical questions about the protocols used for experimental animals and ask whether the procedures were appropriate and met the guidelines in place to protect the welfare of experimental animals. A reviewer may have similar concerns about the procedures used to protect the welfare and privacy of human subjects. Such concerns should be raised in both the comments to the authors and the comments to the editor. The reviewer should cite the specific aspects of the studies that lead to these concerns, and should cite the guidelines or regulations relevant to the concerns. Most journals have explicit policies and ethical expectations for studies using animals or human subjects, and assessing whether papers meet these standards is an important part of the review process.

Similarly, the reviewer may know of or notice a potential conflict of interest on the part of the authors which has not been disclosed in the paper. For example, no funding source may be provided for a study which appears likely to have been funded by the company owning a drug being tested. Most journals have explicit policies stating when the authors' conflicts of interest must be disclosed to the readers and to the editor. The reviewer should note the problem in the review.

Sometimes the reviewer may discover more serious ethical breaches. The reviewer may recognize much or all of the paper, because it has been published previously by the same authors. Alternatively, the reviewer may find text or ideas which have been copied without permission or appropriate attribution from the works of others. The reviewer may feel that the data cannot possibly be correct as presented and may suspect that some data have been fabricated or falsified. Alternatively, the reviewer may feel that the data are sound but that the data have been manipulated or analyzed inappropriately, so that the conclusions drawn from them are deliberately misleading.

Instances of possible misconduct require thought and wisdom on the part of the reviewer and the editors. On one hand, reviewers and editors must take all appropriate steps to preclude publication of duplicate, plagiarized or fraudulent papers. On the other hand, the suspicion of scientific misconduct can have a devastating impact on a scientific career, even if deliberate malevolence is eventually disproved. Because of this, the reviewer should carefully review the facts underlying his/her concerns. In the case of suspected duplicative publication or plagiarism, the reviewer should obtain and carefully examine copies of the original documents to confirm his/her initial impression. The reviewer should then contact the editor in confidence to discuss the problem, and should provide the editor with copies of the original papers. Both the reviewer

and the editor should be extremely discreet, thorough, and thoughtful in their discussions, deliberations and actions related to the paper, recognizing the potential seriousness of the situation for the authors, the journal, and science in general.

Writing the review

Reviews can be difficult to write. They must be clear, concise, and accurate. Although their primary purpose is to advise the editor, the comments to the author frequently are of value in guiding revision of the paper for the same journal or a different journal and in suggesting ways to improve the project by the inclusion of additional data or experiments. Comments to the author may be very brief, especially in the case of an excellent, well prepared paper. They may be extensive if the reviewer feels the paper has valuable elements but requires many revisions and corrections to present the findings effectively. There is therefore an element of mentoring and collegial advising inherent in the review process.

When writing the review, the reviewer should remember that the review will be sent to the authors and that it should be written in a constructive and collegial tone. The content should be constructive and informative. Comments and recommendations should be clear and should be supported with citations to specific figures, tables, or sections of text. When the reviewer's criticisms rely on or are supported by data in the literature, the reviewer should provide citations to the relevant papers. A good review should help the authors to think more clearly about their work and its design, execution, presentation and significance

Some reviewers, hiding behind the mask of anonymity, submit critiques that are so rude, snide, sarcastic, argumentative, or even obscene that they must be censored before being sent to the authors. Some are not transmitted to the authors, depriving the author of any beneficial insights the reviewer might have been able to provide. Gratuitous rudeness, personal criticism and locker room humor are never appropriate. Even the most serious scientific criticisms can be worded and presented in such a way as to be constructive and collegial. Reviewers should write critiques using a style and tone that they would want to see in reviews that they, or their most insecure student, were to receive.

Reviewers should remember that they are setting the standards of behavior and collegiality for their field, as well as the standards of science.

AFTER THE REVIEW

When the review is finished, it is sent to the journal. Because most reviewers prefer to read hard copies rather than electronic text, the reviewer will probably have a paper copy of the manuscript. This should be destroyed immediately in a way that ensures confidentiality. The reviewer should keep a copy of the review itself until she/he is certain that the review has been received by the journal office and that the editor has no questions. This review should be kept safe and confidential until it can be destroyed (the reviewer will not need it; if the journal sends a revised manuscript for re-review, it will also send copies of the initial review).

The reviewer should remember that the need for confidentiality remains even after the review is complete. Both the contents of the paper and the outcome of the review remain confidential until the paper is published.

Even after the paper is published, information on the review process should remain confidential. The reviewer should not reveal the identities of reviewers to the authors. This is especially important when there were differences of opinion between reviewers or when contentious issues were raised during the review process. Some authors remain angry about events that occurred during a review even after the paper is published.

If a reviewer anticipates being in a situation where the paper will be discussed, the reviewer should read the final published version of the paper. It is not uncommon for a paper to evolve substantially during the review process. Data may be added or deleted and the statistical analyses may be refined. It is possible that the conclusions drawn in the paper will be altered or restated more precisely. The reviewer therefore should discuss the published version of the paper, rather than the earlier version that was reviewed in confidence.

CONCLUSIONS

The review of manuscripts for peer reviewed journals raises many ethical issues and problems. The reviewer should be aware of these when deciding whether to review a paper, throughout the review process, and even after the review has been submitted. Some forethought and planning will enable the reviewer to avoid some potential problems. Others may appear without warning. When in doubt, the reviewer should discuss his/her concerns with the editor or the journal staff. The reviewer should strive to provide reviews that meet high standards of ethics as well as high standards of science.

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SUGGESTED READING

WEB RESOURCES:

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