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Scientific Publication and Authorship

Publication of experimental work accomplishes several things. It allows evaluation of results and places them in perspective against a larger body of knowledge. It also credits other scientists, whose contributions and ideas have been used and built upon in the research. It enables others to extend or repeat work by providing a description of experiments performed. Finally, the author byline attributes credit for the work and, perhaps most importantly, establishes who accepts responsibility for it.

Scientists, their professional societies, and the publishers and editors of scholarly journals all agree that the determination of authorship is an important matter. In general, authors must contribute to the reported work in some way; what ultimately gets recognized as an appropriate contribution varies, however. Defining the responsibilities of authorship thus represents an even larger problem. Suppose a published paper contains an honest mistake that has a major effect on the paper's scientific message. It is determined that the mistake is attributable to one of the four coauthors on the paper. Are the other three authors responsible for the mistake as well? Or, does their responsibility simply stop with an adequate explanation of why they couldn't have detected it? If it is determined that the "mistake" was the result of some fraudulent behavior on the part of just one coauthor, are the answers to these questions still the same?

Historically, the scientific community has relied on rather informal, often unwritten, and sometimes ill-defined criteria for determining authorship on scientific papers. This approach has not served scie-
ence well. It can breed misunderstanding, hard feelings, and confusion among the scientists affected by such decisions. The current climate, however, is changing as institutions, societies, editorial boards, and publishers seek to clarify and even codify the criteria used to assign authorship and its related responsibilities. Interestingly, this has occurred in spite of occasional arguments that attempts to formally address this issue impose on academic freedom and stifle creativity.

The Need for Authorship Criteria

Scientists concur that it would be wrong to include as an author on a paper someone who had made no experimental, technical, or intellectual contributions to the work. Similarly, if an investigator performed a key experiment and provided an interpretation of the results, authorship for that person would be obligatory. These extremes have never really been in question, and they can be correctly decided without hesitation. But, unfortunately, the day-to-day decisions on authoring scientific papers fall in between these examples. And the questions of the responsibility of individuals whose names appear on multi-authored papers remain largely unanswered, although they are increasingly debated. “If you are willing to take the credit, you have to take responsibility” is a much used statement that is not as straightforward as one would think in every case of coauthored scientific publications. Many now insist that guidelines, if not policies, are needed which deal with deciding on authorship and defining responsibilities.

The Pressure To Publish

Humanistic realities are superimposed on the practices and standards of scientific publication. Regardless of the setting in which scientific research occurs, publications have become a stock in trade. In academic settings, publications help scientists win grants, promotions, tenure, higher salaries, and professional prestige. For these reasons, there is pressure to publish. Unfortunately, some scientists react to these pressures in ways that lead to irresponsible actions. Temptations to do this abound, and succumbing to them can be easy to rationalize. The need for that “one additional paper” for the progress report of a grant application (to get a grant award), or an employer’s activity report (to get a raise), or one’s curriculum vitae (to get a job) creates pressure to publish. Even if the data are incomplete, there always seems to be some opportunity to publish. The large and growing number of journals in scientific disciplines provides many options for submitting papers. Journal quality and reviewing standards vary so there is likely to be someplace the research can be published.

The temptation to publish incomplete work also crops up as a result of another type of pressure: the need to be “first.” To keep research funding scientists must be productive, and prestige in science is often associated with being on “the cutting edge” of the field. Publishing quickly advertises research progress and the pressures to do this sometimes lead to compromises. Finally, there are a number of other reasons that lead to questionable publication practices. Rationalizations abound, such as, “We didn’t know what to make of the data so we got them out into the literature so others might evaluate them”; or, “It was the last set of results from her dissertation research and didn’t seem to fit in the other manuscripts so we published it independently.”

These pressures to publish have given rise to euphemisms that describe what sometimes happens in scientific publishing. “Salami science” refers to the publication of related results in “slices”: data sets are split and published separately instead of being presented in a unified way. This increases the number of published papers from the same amount of data, giving the impression of increased productivity. Another phrase used to describe a related practice is “the least publishable unit,” or the smallest amount of data that can be written as a manuscript and published. Some publications and editors may be unconsciously contributing to these practices. Publication categories termed “Notes,” “Short Communications,” or “Preliminary Reports” usually accept brief reports of important findings that can stand on their own (the language varies, but the message is the same). When editors and reviewers do not heed their journal’s policies, such brief publication formats open the door to the “salami slicers” and the “reductionists.” The ethics of publishing results in a way to maximize the number of papers is open to debate. Most would argue that it is not inherently wrong and scientists must have the freedom to publish how and what they see fit. However, the fragmentary nature of these publications sometimes makes them difficult to evaluate. They can
mislead the reader and create confusion in the field by giving inappropriate emphasis to a piece of work. Additionally, unjustified multiple publications put undue strain on the peer review process.

Authorship and its responsibilities need to be better defined. In biomedical research, interdisciplinary approaches to problems breed collaboration. This makes multiauthorship the norm, and there is no expectation that the number of coauthors has to be limited. Thus, single-authored research papers have become a rarity. Even at the most fundamental of all levels—the training of students and post-doctorals—the multiauthored paper is appropriate and expected. Mentors and trainees both have a stake in their published work. Defining that stake can be elusive, however, without rational guidelines. Sorting out details, identifying acceptable criteria, and monitoring policies has not been easy. But developing usable guidelines, no matter how “flexible” or “open-ended,” is the responsibility of the scientific community.

This chapter reviews some of the commonly accepted standards of publication and authorship, including the process and responsibilities associated with the peer review of a scientific publication.

Instructions to Authors

Some of the standards for authorship and publication are readily accessible to the novice author. These appear on what may be the least read pages of a scientific journal: the “Instructions to Authors” section. The instructions to authors published in scientific journals provide the details of manuscript preparation required by the journal, its general policies, and often its philosophy of publication (i.e., standards for publication). Sometimes these issues are reaffirmed after the paper is submitted; for example, they may be stated in the letter acknowledging receipt of the manuscript, the acceptance letter, or in material sent with page proofs. Instructions to authors should always be read before beginning manuscript preparation. In fact, consulting these instructions provide guidance when deciding upon which journal to publish in. Journal publishers often use this space to state the kinds of research considered appropriate for publication. This information, along with experience and observation of the published material that appears in the journal, helps with the decision on where to submit a paper. In addition, it is helpful to seek the advice of experienced colleagues on where the work might be best published. Instructions to authors appear in every issue of some journals. In others, they appear periodically, but reference to their location is published somewhere in every issue.

Details of manuscript preparation

Instructions to authors contain essential information needed to prepare and submit the manuscript. Details on format, space constraints or word limitations, figure preparation, the use of abbreviations and symbols, and proper chemical, biological, and genetic nomenclature are found therein. For symbol and nomenclature information, many journals use varying authoritative reference books or guides as their accepted standards. Instructions to authors often contain housekeeping details such as how many copies to submit, where to mail the manuscript, and, where appropriate, the cost of page charges. Finally, some journals provide guidance on the preparation of the various sections of the scientific paper: the abstract, introduction, materials and methods, results, and discussion. Such guidance is useful to the novice writer. Reading the journal’s guidelines on how to prepare these sections is preferable to trying to deduce them from reading papers published in the journal (although this can help too).

Authorship

Some journals more or less define authorship and its responsibilities. The words ultimately boil down to the same two issues in the vast majority of examples. First, an author has to make a significant contribution to the work. Most statements like this leave plenty of room for interpretation, and thus are flexible (a trait favored by some and opposed by others). Second, statements defining authorship often mention that all authors on a manuscript take responsibility for its content. With multiauthored papers, statements are occasionally included that indicate that all of the authors consent to its submission, or that they all have read the manuscript. Such statements have important meaning in setting the stage for the broader issues of authorship responsibility.

Copyright

A usual condition of manuscript acceptance for almost all, if not all, scientific journals is that the authors assign the copyright to the publisher (this is discussed in more detail in Chapter 8). Usually the senior author (sometimes called the corresponding author) is empowered to
do this for all coauthors. Also, many journals require that authors obtain permission to use any copyrighted material that is included in their manuscript (for example, a diagram from a previously published paper). This is usually a formality that involves writing the publisher who holds the copyright for the work to be included. The letter should describe the intended use of the copyrighted material. Many publishers have forms that can be completed in lieu of a letter.

Manuscript review
Matters relating to the peer review of the manuscript often are found in the Instructions to Authors text. Some journals allow authors to suggest the names of impartial reviewers, either ad hoc referees or members of the editorial board. This assists the editors with their job and it is wise to take advantage of the opportunity where it exists. In this context, who qualifies as an impartial reviewer? Opinions vary and criteria are subjective. Often excluded as impartial reviewers are (1) people at the author’s institution, (2) people who have been associated with the author’s laboratory, and (3) the author’s collaborators or coauthors at other institutions. Individuals in the latter two categories are considered in view of the time period that has elapsed since the author’s last interactions with them. Such things must be evaluated on a case-by-case basis. Potential conflict of interest related to the suggestion of peer reviewers is often best determined by the author. Common indicators of conflict of interest are manifest in one’s spending inordinate amounts of time rationalizing suggestions for a reviewer, or an uneasiness that comes with discussing proposed reviewers with other colleagues.

Often a description of the peer view process is found in the Instructions to Authors section. The process also may be described in the letter or card that acknowledges receipt of the manuscript. Authors need to become familiar with this process and understand how it works. It can vary significantly for different journals. Understanding the process will facilitate handling of the manuscript during peer review. The typical path of a manuscript through the review process will be presented later in this chapter.

Prior publication
The varied Instructions to Authors sections are usually quite explicit about the issue of prior publication. Work may not be submitted that has been previously published or has been submitted to another jour-
nal. One publisher has invoked the concept of the primary scientific publication to help clarify this issue. Robert Day in his book How to Write and Publish a Scientific Paper (4th edition) defines the primary publication as “(i) the first publication of original research results, (ii) in a form whereby peers of the author can repeat the experiments and test the conclusions, and (iii) in a journal or other source document readily available within the scientific community.”

However, most would argue that issues of prior publication are far from straightforward. Ambiguity frequently exists when considering, for example, papers published in monographs (e.g., invited short papers or meeting proceedings). It is not easy to determine how “readily available” a source may be. How many copies of a monograph have to be sold or distributed in order for it to fall into this category? If all copies of the monograph have been distributed in the United States, is it acceptable to submit essentially the same work to a journal published in Europe? Some argue that original work published in conference reports, symposia or meeting proceedings, or the equivalent monographs is by definition preliminary due to considerations of format and space. Often methods cannot be fully described. They also argue that such work is usually not subjected to peer review. The potential for self-deception is large, however, and scientists generally agree it is wrong to publish the same material as a primary publication in two different places. Using that philosophy as a guide is highly recommended.

Unpublished information cited in manuscripts
Some journals require proof of permission to cite the unpublished work of others. Thus, information provided by a colleague as a “personal communication” may require a letter granting permission. The same may be true for preprints or submitted manuscripts provided by one’s colleagues. This practice is increasing among publishers of scientific journals. Such language mandates formal communication among scientists and can avoid potential problems. For example, a colleague might provide a manuscript that has been submitted for publication, but she may not feel comfortable allowing the work to be cited in another paper before she knows whether it has been accepted. By formally asking her permission, any prospect of misunderstanding is eliminated.
Regarding the author's unpublished work—"in press" or "submitted" manuscripts—an increasing number of journals require that copies of such manuscripts accompany the new submission so that they can be used if needed during peer review.

Sharing research materials
In natural science and biomedical journals, it has become standard for publishers to include statements about sharing research materials. This includes cell lines, microorganisms, mutants, plasmids, antibodies, and other biologicals or reagents. There are usually conditions stated for the release of such materials. For example, materials must be available at cost (e.g., preparation and shipping), they must be requested in reasonable quantities, and they must not be used for commercial purposes. Scientists also usually observe the practice of requesting materials from the authors of the publication in which the material was initially described. For example, it is not acceptable to request a bacterial strain from a third party, even though it may be convenient to do that. A mutant critically needed for work in Chicago may have been constructed by a scientist in Japan, but may already be in the possession of a colleague in a nearby city. It is not appropriate to ask the stateside colleague to provide the mutant. One should ask the Japanese investigator who originally constructed it and published the results. At the very least, you might suggest that he allow you to get a culture from your conveniently located neighbor.

The sharing of research materials might also be mandated by author's instructions that request that authors properly deposit specialized data in appropriate databases (e.g., nucleic acid sequences and X-ray crystallographic data). The exchange of research materials and the proper deposition of results into databases are usually listed as conditions of acceptance for the paper.

Conflict of interest
Scientific journals may ask authors to disclose their financial associations with companies whose activities might be affected by the results of the paper. If the paper is accepted, this disclosure is usually handled on a case-by-case basis. Potential conflict of interest disclosure is, however, likely to become a more prominent issue as research sponsored by the biotechnology industry continues to increase in academic institutions and in noncommercial research institutes. Thus far, related language in author's instructions has been found primarily in bio-

medical journals that publish research with clinical implications. Other related issues will undoubtedly have to addressed. For example, what about parallel conflicts involving members of editorial boards who serve as reviewers for such papers? What about editors themselves who may have financial associations with companies whose activities may overlap with the content of journal articles? Is that conflict of interest, real or perceived? How can such issues be monitored and how are conflicts handled when they are identified? There are no ready answers, but the need for dialogue, careful consideration, and the development and implementation of policies is apparent.

Imperfections
Some journals also include policies on the handling of disputes once papers are published. Occasionally, journals are explicit about the option of having their editors examine original data in the process of dispute resolution. In addition, many journals describe policies for publishing corrections, errata, or retractions of papers.

Guidelines for Authorship
In seeking the definition of authorship, what is the test for determining the difference between "earned authorship" and "honorary authorship?" Scientists may hold the former to be right and the latter wrong, but there is certainly a continuum between the two. Making decisions along the continuum is difficult when arguments persist over the definitions of the endpoints—those that are unqualified as acceptable or unacceptable. Considerable agreement exists on what is unacceptable. However, there can be great differences of opinion on what earns someone the right to authorship. Although some journals have provided guidance on defining authorship and its responsibilities, the language includes sweeping statements that provide much latitude for interpretation. Such broad-based guidance is of limited value to the novice writer or trainee.

Definitive answers to questions about authorship and its responsibilities must come from the scientific community itself. In recent years attempts at solutions are coming from the institutions in which scientists practice. Some institutions now publish guidelines on the meaning and definition of authorship. Additionally, there is an increasing related literature that comprises books, editorials, and special articles. A sampling of these kinds of writings, some of which include
institutional guidelines, is given in the references section of this chapter.

Authors need to understand and abide by the guidelines of their institutions, if such guidelines exist. If not, the topics covered here should provide a general substrate for thinking about authorship. Discussions among and between trainees, mentors, and colleagues will also clarify the issues and facilitate an understanding of an appreciation for the nuances of authorship.

The following sections outline material collected from various guidelines and deal exclusively with coauthored manuscripts.

The senior author
A familiar term is that of senior author (sometimes called primary author). Guidelines often define this person as the principal investigator, leader of the group, or laboratory director. If the byline of a paper lists a faculty mentor along with two of her predoctoral trainees and one postdoctoral trainee, then the mentor is the senior author.

The senior author may or may not be the first author listed on the byline. In general, most agree that the first author is defined as having played a major role in generating the data, interpreting the results, and writing the first draft of the manuscript. In many cases, however, the first author and the senior author are different people. When this is so, it is customary for the senior author’s name to be last in the byline. Sometimes papers are authored by more than one person of senior status. Most of the time it is still possible to define one of the two as the senior author of the paper, based on their respective contributions as well as the contributing roles of the other coauthors (e.g., in which senior author’s lab was the work done). It is sometimes possible for senior authorship to be shared; this designation and the position of the names of the senior authors on the byline should be decided by mutual consent.

Responsibilities of the senior author
Guidelines often vest senior authors with overarching responsibilities. What follows is an amalgamation of the typical responsibilities listed in several documents from universities and research institutions.

The senior author (and first author if different) decides on who else will be listed as coauthors. General criteria for making these decisions are discussed below. The senior author is responsible for notifying all coauthors of this decision and for facilitating discussion and determining the order of appearance of the coauthors’ names on the byline.

The senior author (with the help of the first author and sometimes other coauthors) decides as well on the names of people to be listed in the acknowledgments section. The senior author should notify individuals who are to be acknowledged. He or she is also responsible for listing in the acknowledgments all sources of financial support for the work. In short, the senior author is responsible for appropriately acknowledging all variety of contributions to the work reported in the paper.

Senior authors review all data contained in the paper and, in doing so, assume responsibility for the validity of the entire body of work. This assertion, which is commonly being written into institutional guidelines, can present problems when specialized work reported in the paper falls outside the senior author’s area of expertise. Here, the senior author should gain a reasonable understanding and verification of the data from the appropriate coauthor. This problem, however, persists as interdisciplinary research proliferates and researchers from highly technical and specialized fields collaborate and copublish their results. Nonetheless, current guidelines are very specific on this point: the senior author must “understand the general principles of all work included in the paper.”

The senior author has an additional responsibility to facilitate communication among coauthors during the preparation of the manuscript. This can mean reviewing raw data and discussing new ideas for additional work. It certainly means reaching agreement on the part of all coauthors as to interpretation of results and conclusions. He or she should also be able to describe the role and contributions of all coauthors in the work. Some institutions require that this be done in writing, with the documentation being retained in appropriate departmental files. Some institutions require a signed document from coauthors indicating their approval of the manuscript and their permission to submit it for publication. In fact, there are journals that require that the letter covering the submitted manuscript indicate essentially the same thing; the letter must be signed by every coauthor.

The senior author ensures that the logistics of manuscript submission are properly followed. This would include such things as
manuscript format (and related material) and local editorial review where required as well as all dealings with the publisher. Matters associated with the publisher might include things like correspondence, execution of copyright assignments and authorship agreement forms, and, where appropriate, financial arrangements such as page charges and reprint costs. The senior author should establish a policy regarding distribution of reprints of the paper, including the provision of a reasonable number of reprints to all coauthors.

The senior author coordinates and oversees the responses to the peer reviewer's comments if the manuscript has to be revised. He or she should involve the coauthors in this process as appropriate, and seek their approval before submitting the revised manuscript. Once the paper is published, the senior author is responsible for acting on and honoring requests to share materials from the research, as well as for coordinating and making responses to general inquiries or challenges about the work. He or she also assumes responsibility for handling the publication of corrections, errata, or retractions, including coordinating preparation of such items by agreement of all coauthors. Finally, the senior author has responsibility for the appropriate retention and storage of all data used to prepare the manuscript.

The first author
This is the author whose name appears first on the byline of the paper. This person may also be called the principal author (although this can be a confusing term since the senior author is usually a principal investigator). As mentioned earlier, the first author is the person who participated significantly in the work by: (1) doing experiments and collecting the data, (2) interpreting the results, and (3) writing the first draft of the manuscript.

The submitting author
This term is occasionally used to describe the person who sees the manuscript through the submission process: letter writing, coordinating responses to the editor, responding to peer review comments, etc. Sometimes this person is called the corresponding author. This is usually the senior author, but it can be the first author. For example, a mentor (senior author) may want his postdoctoral (first author) to gain experience in dealing with the peer review process. It should be remembered that when this happens certain related responsibilities discussed previously would fall on this author. Many publishers identify the submitting author on the first page of the published article. Thus, the responsibilities of the senior author with respect to correspondence after publication would lie with the submitting (or corresponding) author when this happens. Where the submitting author and senior author are not the same person, there should be an advanced understanding of how follow-up correspondence related to the manuscript will be handled (e.g., requests for biologic materials, etc.).

Other coauthors
Coauthors whose names appear between the first and last authors on the byline are usually decided upon by the senior author and the first author. The order of these coauthors can be based on the importance of their contributions to the work in descending order from the first author. Decisions on authorship need to be made before the paper is written. It may be appropriate to change the order of the authors as the work and manuscript preparation progress. The senior and first authors should guide any process to revise author order, but such decisions should involve all coauthors.

What counts toward authorship?
Authorship encompasses two fundamental principles: contribution and responsibility. An author must make a significant intellectual or practical contribution to the work reported in the paper. With such authorship goes the responsibility for the contents of the paper. By keeping such concepts simple, the qualitative and quantitative aspects of these contributions and the precise nature of the responsibilities are left open to interpretation. This flexibility is valued by many in the scientific community. Nonetheless, the articulation of authorship contributions and responsibilities by institutions provides clarity that aids both the seasoned and the novice author.

The meaning of “authorship” has been defined in a variety of ways. Significant contributions are frequently described as things that have an effect on the “direction, scope, or depth of the research.” They can also include “conceptualization, design, execution, and/or interpretation of the research.” The development of necessary methodologies and data analysis essential to the conclusions of the project are also sometimes listed as contributions which justify authorship. Sometimes the language gets specific and contributions to the project are linked to having a “clear understanding of its goals.” This leads us to the issue of responsibility.
Responsibility has been linked to authorship as the need “to take responsibility for the defense of the study should the need arise” or “to present and defend the work in context at a scientific meeting.” The challenge of coauthor responsibility (where contributions are often disparate) can create exceptions when “one author has carried out a unique, sophisticated study or analysis.” In other words, it can be argued that in certain collaborative studies, it may not be possible for every author to be able to rigorously present and defend all aspects of the work.

What doesn’t count
In many of the guidelines, naming the things that don’t merit authorship has been as helpful as naming those that do. Just providing funding for the work, or status as a group or unit leader, does not alone justify authorship. Neither does providing only lab space or the use of instrumentation. Finally, doing routine technical work on the project, providing services or materials for a fee, or merely editing a manuscript is not sufficient justification for authorship.

Peer Review
Many scientists get called on to review manuscripts. This generally happens in two ways. First, scientists may be appointed as members of editorial boards of scientific journals, in which case their duties as reviewers are formalized. Editorial board members regularly get papers to review and their names appear in each issue of the journal designated as “reviewing editors” or as editorial board members, or some equivalent term. Second, scientists get asked to be ad hoc reviewers. In this case they receive papers to review from editors and are asked to evaluate them as a courtesy. Usually, ad hoc reviewers’ names are listed in the last journal issue of the year acknowledging them as reviewers. Many scientific journals in the biomedical and natural sciences rely heavily on the services of ad hoc reviewers.

Editorial board members and ad hoc reviewers provide a critical service. They prepare written evaluations that help the journal editor decide on the acceptability of the submitted manuscripts. Equally important, their comments usually allow the authors to improve their manuscript if it is not acceptable for publication in its current form. A reviewer’s commentary may suggest improvements in writing style, presentation of data, or even additional experiments.

A scientist named to an editorial board is likely to receive from the journal editor or publisher guidelines on how to prepare a review. Over time, the editor may give advice on written reviews and offer suggestions on how to improve them, thus providing ongoing guidance to reviewers.

Ad hoc reviewers are often asked to serve before being mailed a manuscript. Such requests may come by phone, fax, or computer mail. At that time it is a good idea for potential reviewers to check with the editor’s office to see if guidelines are available. These are usually brief and can be very helpful; reviewers should secure a copy where possible before beginning a review. A novice reviewer is otherwise likely to have a single frame of reference: reviews previously received on their own manuscripts.

The peer review process for scientific articles has come under scrutiny in recent years, and some have called for radical change or complete abolishment. With that said and accepting peer review as an important element of responsible scientific conduct, we will present the process here in two parts. First an examination will be made of the flow of a manuscript through a typical cycle of peer review. This will be followed by a discussion of the duties and responsibilities of the reviewer.

How Peer Review Usually Works
Typically, peer review begins with submission of a manuscript by mail to an editor or to a central office of the journal publisher. In the latter case the office then assigns the manuscript to an appropriate editor. Typical scientific journals have multiple editors who represent the various subspecialties of the subject matter published in them. The editor then reads the paper (or enough of it) to decide on whom to invite to complete the review. Editors may select editorial board members or ad hoc reviewers for this job. Typically a single paper is mailed to two or more peer reviewers (also termed “referees”). Some journals have special forms on which to prepare manuscript reviews, but these frequently merely consist of blank space for reviewers to write comments. There can also be a separate form for comments that are intended only for the eyes of the editor. The editor asks for the reviewers to complete their evaluations in a specific period of time (usually less than a month). When the completed reviews are returned to the editor, he or
she reads them carefully and then makes one of three decisions: (1) to accept the paper, (2) to reject the paper, or (3) to return the paper to the authors for revision. In all cases the editor sends to the authors a letter indicating his or her decision and its basis. Obviously, in the case of outright acceptance, the letter is brief. However, editors are usually specific in their decision letters when explaining rejection or the need for revision. Such letters reflect the editor’s own opinions of the paper in view of the reviewers’ comments and recommendations and are accompanied by the verbatim copies of the reviewers’ comments. Those sections of the review form that indicate reviewers’ specific recommendations (“accept”, “reject” or “revise”) as well as any comments made in confidence to the editor are not sent to the authors. Editors may and do use comments sent to them separately by reviewers to help in composing their decision letter.

For most scientific journals in the biomedical and natural sciences, the comments of the reviewers are anonymous. However, some journals do reveal reviewer identity to the authors. This can be done as a matter of policy or by encouraging reviewers to sign their written reviews. At least one journal publishes the reviewers’ comments along with the corresponding papers.

Authors must consider the reviewers’ and editor’s comments in revising their papers. They may make changes based on comments they agree with. Alternatively, authors have the right to rebut any and all criticisms of the reviewers. The basis for handling each reviewer’s comments must be explained to the editor in a letter that accompanies the revised manuscript. It is then the editor’s job to reach a final decision on the paper and to notify the authors.

Being a Peer Reviewer

What to do when the manuscript arrives
There are a number of “housekeeping” chores that reviewers must do when a manuscript is received by mail and it is important (and courteous) to attend to these quickly. First, the reviewer must scan the paper and decide whether he or she is qualified to review it as well as whether he or she can complete the review in the time being allotted by the editor. If the reviewer is uncomfortable with either of these criteria, the manuscript should immediately be sent back to be reassigned. At this time, reviewers should check that they have a complete version of the manuscript. Are all the pages, figures, and tables there? If things are missing or illegible (e.g., photocopies of micrographs instead of originals), the editor or editorial office should be contacted about the missing or needed material.

Reviewers must be comfortable with their ability to impartially review the work. In other words, their review of the paper must not constitute a conflict of interest—real or perceived. Some journals have guidelines for this. As mentioned earlier, typically cited conflicts include papers from investigators at the reviewer’s institution, trainees who have recently been in the reviewer’s lab, or collaborators of the reviewer at other institutions. Commercial interests also create conflicts. For example, is the paper authored by scientists at a company that pays the reviewer as a consultant or has made a grant or gift to the reviewer’s research program? Conflict of interest decisions of this type usually rest with the reviewer. Usually, the information that points to the conflict is known to the reviewer and not the editor and hence he might never become aware of it. The reviewer has to decide whether there is conflict or whether others might perceive specific actions as conflict. A simple rule is, when in doubt, don’t review the paper. The reviewer may contact the editor to seek advice on matters of potential conflict. In general, any extensive rationalization for overcoming what might be a perceived conflict is usually a signal to both the reviewer and the editor that a real conflict may exist or may be perceived to exist by others. In such cases, reassignment of the manuscript to another reviewer is necessary.

If a reviewer returns a manuscript for reassignment, it is an accepted courtesy to tell the editor the reason for doing so. It is also customary to suggest the names of potential substitutes. Such assistance is valuable and editors appreciate it.

Philosophy of review
The peer reviewer’s task is twofold: (1) to help the editor make a good decision on the acceptability of the paper, and (2) to help the authors communicate their work accurately and effectively. The peer reviewer does not have to be an adversary to do either of these jobs; indeed, in the latter case, he or she should be an advocate for the authors. Guidelines sometimes tell reviewers to take a positive attitude toward the manuscript, and this is good advice. Reviews who are confrontational are distressing to authors and often make things difficult for
all involved. Meaning can get lost in impolite and ill-considered language, and can confuse an editor’s attempt to effectively evaluate the reviewer’s comments. It can also distract and mislead authors in preparing their rebuttals. Issues can be clouded by offensive language. Authors may “miss the point” and in doing so fail to improve their manuscript. Additionally, time is often wasted as authors feel the need to respond in kind to offensive comments in their rebuttal letters to editors.

Confidentiality
A manuscript sent to a reviewer is a privileged communication and represents confidential information. It should not be copied by any means nor shared with colleagues. Under no circumstances should the reviewer get assistance from colleagues in performing the review without explicit permission of the editor.

A customary policy is that a peer reviewer never contact an author directly about the manuscript under review. This may sound like unnecessary advice, because most journals use anonymous review. However, even if journals allow disclosure of the reviewer’s identity to the authors, direct contact between the two during the review process is usually forbidden. The information the reviewer provides on the merit and acceptability of a manuscript is considered by the editor, who makes the final decision. By talking to authors, reviewers may communicate misleading messages that can make the editor’s job difficult. Thus, reviewers who need clarification or additional information should always contact the editor and let him or her obtain it.

Commonly used criteria for evaluating merit
The manuscript should contain a clear statement of the problem being studied and it should be put in perspective. Reviewers should evaluate this perspective in the context of appropriate literature citations. In other words, do the authors give appropriate credit to prior work in the field, especially those contributions upon which the present report is built? The originality of the work should be carefully weighed. The reviewer should consider whether the manuscript reports a new discovery as opposed to extending or confirming some previous work.

Experimental techniques and research design should be appropriate to the study. Did the authors use the right tools and techniques to test their hypotheses? Description of methods is very important.

This is the part of scientific communication that allows verification of the work. The description of the materials and methods should be in sufficient detail that other investigators in the field can repeat the work. It is, however, appropriate that some methods be briefly mentioned and then cited in the reference section of the paper. However, it is important that such citations refer to the source where complete methods are described. Papers should not be used as methods citations if they contain incomplete descriptions, or if they refer to yet another paper for the details of some or all of the method.

The reviewer should examine the presentation of data for clarity and effectiveness, keeping in mind several questions. Is data presentation cluttered or confusing? Are figures and photographs clear? What about the organization of the data in tables and figures? Are there too many tables or figures? Can some be deleted? Are data given in tabular form better presented in figures? Should data in tables be combined or single-panel figures be redone as multipart panels?

Interpretations of the data need to be sound and clearly worded. The discussion of the work should be appropriate: arguments should be logically presented and any speculation should be built on the present work and the existing literature.

The writing in the manuscript should be clear, easy to follow, and grammatically correct. Many guidelines affirm that the peer reviewer’s job is not to rewrite the manuscript. However, some comments by the peer reviewer citing examples of writing deficiencies will help the authors when making global revisions. The reviewer should also note whether the authors are adhering to correct scientific nomenclature and abbreviations as specified by the journal.

The reviewer should evaluate the title and abstract after reading the paper. Are they adequate and appropriate? As electronic communications increase, the availability of abstracts is becoming widespread. The abstract has become the “first line” of scientific communication in this medium; therefore, the abstract needs to clearly describe the essence of the problem, how it was attacked, and the outcome of the research.

Writing the review
The actual format for preparing a manuscript review varies from journal to journal. However, it is typical for a review to begin with a paragraph or two that includes a summary of the major findings and
Providing peer review of scientific publications is an obligation that is shared by scientists. While peer review must be scholarly and rigorous, it must also be timely, respectful, and courteous. Above all, peer review must be constructive. Peer review plays a vital role in the publication of research findings, although the process is being increasingly challenged. Its workings and effectiveness are likely to be the subjects of continuing debate among scientists for years to come. Nonetheless, the process of peer review is performed under both written and unwritten guidelines. Explicit descriptions of duties and responsibilities of peer reviewers are now frequently published by scientific journals. In part, these aim to foster consistency and integrity in the process.

Conclusion

Written communication is an essential part of scientific research. Science can benefit society only insofar as its findings are published and applied. Indeed, biomedical scientists have a moral obligation to share new knowledge in order to advance and improve the health and well-being of humankind. Scientific knowledge is accepted only when the published research results that support it hold up under scrutiny and independent corroboration. The duties and responsibilities of scientific authorship are not to be taken lightly. Historically, many of the decisions about authorship on scientific papers were based on unwritten norms and standards. In recent years, written guidelines for authorship are being promulgated by institutions, societies, and journal publication boards. These provide guidance to authors and they can be especially informative to the novice writer.
Case Studies

4.1 You are a member of a large scientific society that publishes several peer-reviewed journals. The publications board of this society has proposed a new rule that is being voted upon by the entire society. The rule states: "Any manuscript submitted for publication in a journal of the society which lists more than 4 (four) authors must be accompanied by a letter from the corresponding author stating the respective contributions of each and every listed author on the manuscript." How will you vote? Why? Discuss your perception of the proposed rule, including any modifications you'd like to see made to it.

4.2 An investigator has published a brief description of a bacterial mutant strain (including data on a biochemical assay of its phenotype) as a full-length paper in a peer-reviewed journal. She is contacted by a colleague who requests the mutant strain. The colleague clearly describes his intended use for the mutant in studies which are presently ongoing in his laboratory. The author of the manuscript refuses to release the strain. She cites that it was only described in a preliminary way in the paper. Moreover, she indicates that another major manuscript is in preparation in which the particular mutant will be the central focus of the report. She says she will be happy to release the mutant after the second manuscript has been accepted for publication. Is the investigator justified in her actions? Why or why not?

4.3 An investigator prepares a manuscript for submission to a prestigious journal in cell biology. A colleague of his in a separate department at the same institution is a member of the journal's editorial board. The investigator submits the manuscript for consideration by the journal to his institutional colleague. They briefly discuss conflict of interest implications of this action but decide that because the manuscript will be reviewed by at least two outside referees, it can be appropriately handled by the editor without a perceived conflict of interest. Do you agree or disagree with this decision? Why or why not?

4.4 A member of an NIH study section is in the process of reviewing several grants assigned to her in connection with an upcoming meeting of the study section. During this process, she receives by mail a manuscript from a journal editor and is asked to review it as an ad hoc reviewer. The author of the manuscript turns out to be the principal investigator of one of the grants the study section member is currently reviewing. Indeed, the manuscript in question has been submitted as an appendix to the grant application. The study section member elects to review the manuscript sent to her by the journal editor. Comment on the appropriateness of her decision to review the paper.

4.5 A faculty member receives a manuscript for ad hoc review from the editor of a scientific journal. He gives the manuscript to a senior postdoctoral associate in his group and asks her to read the manuscript and prepare some written comments on it. One week later, she provides one page of handwritten comments to the faculty member and they briefly discuss the manuscript. The faculty member then prepares a written review which is submitted to the editor of the scientific journal. A few weeks later, the faculty member learns that the postdoctoral associate made photocopies of the entire literature citation section of the manuscript because it contained "some useful references." The faculty member proceeds to reprimand the postdoctoral associate, telling her that no part of a manuscript received for review should be copied. Comment on the behavior of both the faculty member and the postdoctoral associate in this scenario.

4.6 A graduate student in a cell biology department has purified two recombinant proteins as part of his dissertation research. These proteins differ only in a few key amino acid positions. Based on standard available biochemical data, the student believes the proteins are virtually identical. In discussions with a graduate student from the biochemistry department, the cell biology student concludes that it would be reasonable to compare these two purified proteins by circular dichroism. The graduate student in biochemistry offers to collaborate on the project by analyzing the two proteins by this technique and presenting the data to the cell biology student. The faculty advisor of the biochemistry student is told of this and he proceeds to tell the advisor of the cell biology student that he expects this will be a fruitful collaboration which should result in a coauthored publication. He argues that his rationale for this is based on his student's intellectual contri-
4.7 A faculty investigator develops a DNA probe as a "side project" working under NIH grant funding. Although not immediately applicable, this DNA has potential in the diagnosis of a latent viral disease in humans. She publishes her results in a peer-reviewed scientific journal. Following the appearance of this work, the faculty investigator is called by a director of research of a large U.S. pharmaceutical firm. The research director requests a plasmid carrying the probe sequence for use in his company's research. The research director assures the faculty investigator that the company has no intent of commercializing the DNA probe. The investigator refuses to comply with the request for the DNA probe, claiming that the potential for commercialization is always present in the research environment of a for-profit company. The director of research counters with the fact that the faculty investigator has published her results and must release the material under the standards of publication set by the peer-reviewed journal. What are the intellectual property and data ownership considerations that surround this issue? Can it be resolved? How?

4.8 A colleague has come to you for advice regarding a recently published paper which contains data similar to results he published approximately six months previously. Your colleague is upset because the paper reaches the same conclusions as his work using somewhat similar approaches, yet the authors fail to cite his work. Although he personally does not know any of the authors on the paper, your colleague can't imagine that they have not seen his previously published work. Both his paper and the new manuscript have appeared in different but comparable journals of the discipline. He is very upset about this matter and seeks your advice on what, if anything, he can and should do. What do you tell him?

4.9 A new postdoctoral is recruited to a laboratory where research is centered on the cell biology of a specific mammalian cell type. The postdoctoral's training has been in eucaryotic gene cloning and molecular genetics; no such technology is available in this laboratory or the department. The new postdoctoral completely trains a senior-level graduate student working in the group. The student proceeds to build a cDNA library of the cell type in question and isolates by molecular cloning a gene for a membrane protein. Several months later a manuscript describing this work is prepared for submission. The principal investigator (PI) of the laboratory and student are listed as coauthors. The postdoctoral is listed in the acknowledgment section of the paper. The postdoctoral is upset with this disposition and confronts the principal investigator. The PI indicates that she has strict rules about authorship and that the postdoctoral's contribution was a technical one which does not merit qualification for authorship. The PI quotes from several different standards-of-conduct documents indicating that authorship must be strictly based on intellectual and conceptual contributions to the work being prepared for publication. Technical assistance, no matter how complex or broad in scope, is not grounds for authorship. Comment on this situation.

4.10 You are an editor of a journal. Manuscript reviews are handled in confidence and ad hoc reviewers are always sent guidelines regarding confidentiality. They include statements that restrict the divulging of manuscript contents to anyone, or using results reported in the paper to advance one's own research. You carefully check manuscripts before sending them out for review to ensure that they are complete with respect to text pages, tables, figures, etc. A stapled copy of a manuscript is sent out to an ad hoc reviewer (with confidentiality guidelines). Two weeks later the paper is returned with a negative review, recommending rejection of the paper on the grounds of its results being too preliminary (although potentially exciting). You happen to notice that the manuscript has had the original staple removed and apparently has been restapled. This prompts you to examine the
entire paper, upon which you discover the text page 9 is missing but there are duplicate page 10s. Based on this, you suspect that the reviewer has photocopied the manuscript and has retained a copy. What, if anything, do you do as editor? Would any of your proposed actions differ if the review had been positive, recommending acceptance of the paper?

4.11 You are editor-in-chief of a prestigious cell biology journal. About a year ago you personally handled and accepted an important manuscript (from Dr. Barbara Smith) which described a novel tumor cell line. This cell line derives from an unusual rodent liver tumor, grows rapidly in vivo, and produces several new membrane proteins. You recently read a paper from another research group (Dr. Jeffrey Wilson) that reports the cloning and characterization of one of these novel membrane protein genes. Shortly after the appearance of the Wilson group’s paper, you receive a phone call from Dr. Smith. She is upset and claims Dr. Wilson has acted unethically. She goes on to say that Dr. Wilson requested the cell line from her, explaining that his reason for wanting it was to explore its genome for standard and novel retrovirus genes. The cell line specifically was released to Dr. Wilson with that understanding, agreed to by both parties in writing. Dr. Smith is upset because her group had been working on the cloning of the genes specifying the novel membrane proteins; now they have been partially “scooped” by Dr. Wilson. She accuses Dr. Wilson of obtaining the cell line under false pretenses. Dr. Smith asks your advice on what to do. She specifically requests that you pursue this as editor-in-chief of the journal, claiming that the behavior violates common publication ethics. What advice do you provide? What, if any, are your responsibilities as editor-in-chief? What, if any, actions do you take as editor-in-chief? Consult the “publication policies” documents from one or more appropriate journals to assist you in your deliberations and decision.

4.12 You are editor-in-chief of a major scientific journal. You receive a call from Dr. Martha Green, who indicates that she has discovered that a member of your editorial board has received a paper listing her name (along with three other individuals) as an author. Dr. Green indicates that, although one member of her research team performed some experiments in his laboratory during a summer sabbatical, Green herself was not involved in the writing of the research paper nor was she sent a copy of the manuscript prior to its submission. The scientific journal of which you are the editor-in-chief has very stringent regulations on defining authorship and has as its explicit policy that manuscripts be submitted with the full knowledge and full approval of all individuals listed as authors. Dr. Green is very uncomfortable with what has happened and asks your advice on how to proceed. What advice do you provide? What, if any, action do you take with regard to this manuscript? The timing of events is such that the paper was submitted approximately one month ago. This means that your editorial board member has undoubtedly sent the manuscript out to at least two expert reviewers in the field.

REFERENCES