CHAPTER 1

Ethics in Scientific Publication

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The principles that govern the ethics of scientific publication are no different than for any other endeavor: complete and accurate reporting and appropriate attribution to the contributions of others. However, as always, “the devil is in the details.” The ethical responsibilities of authors and reviewers are sufficiently important and complex that the editors of the American Chemical Society journals have developed a detailed document outlining these responsibilities. (This document, “Ethical Guidelines to Publication of Chemical Research” is presented in Appendix 1-1.) The purpose of this chapter is not to duplicate this document, but rather to discuss some of the important underlying principles and situations that often arise.

Scientific research, perhaps more than most professions, crucially depends on the integrity of the investigators. Most research consists of a series of complex experiments or theoretical calculations that cannot (or will not) be duplicated easily elsewhere. Moreover, it is usually extremely difficult to determine in detail if the results are correct and can be trusted. Published results generally are accepted at face value. Very often related work eventually may be done by others that tests the results, so that checks and balances exist within the system. This is usually a long process, however, and the advance of science may be significantly delayed if published results are not correct. The bottom line is that we depend on the integrity of the investigators reporting the results. We assume that the description of the work is accurate and honest unless proven otherwise. This places a considerable burden on the authors to ensure that the system works.

Research is by its nature exploratory, and honest mistakes may occur. Errors due to human fallibility are unfortunate, but not unethical. Research inevitably
pushes the boundaries of existing methodology and theory, so that errors in judgment and interpretation are bound to occur. This is a normal part of the scientific establishment. An often-quoted adage is that the only way never to make a mistake in print is never to publish. Errors due to carelessness or haste are poor science; they represent irresponsible, but not unethical, behavior.

Errors due to fabrication and falsification clearly are unethical and cannot be tolerated under any circumstances. Breakdowns in the system that are not honest mistakes have occurred; some examples are published by the Office of Research Integrity of the U.S. Department of Health and Human Services at http://ori.dhhs.gov. Fortunately, these breakdowns seem to be relatively few.

It is the responsibility of each author to ensure the quality and integrity of the research that is reported. The ethical principles governing the conduct of science should be well understood by all participants. This chapter considers only some aspects of this subject. An excellent introductory publication is available online from the National Academy of Sciences; see “On Being a Scientist: Responsible Conduct in Research” at http://www.nap.edu/readingroom/books/obas/.

**When To Publish: Significance and Timeliness**

When is it time to publish? Research is open-ended, so the answer to this question is not always obvious and requires authors to balance significance and timeliness to arrive at a high-quality manuscript.

**Reminder:** Research should be published in a timely manner when enough work has been done to yield significant results.

Researchers must decide when enough work has been done to make a significant contribution to a field. “Significant” is in the eye of the beholder, and sometimes reviewers and authors will differ markedly with regard to this judgment. The give and take between authors and reviewers is part of the normal process of science and undoubtedly improves the quality of published work. Clearly neither science nor scientific publishing are enhanced by a continual stream of short, incomplete descriptions of a research project. A publication should describe a project that is complete unto itself and represents a true advance in the field. (An exception to this rule occurs when a very unusual result is obtained that is of great interest and significance—in this case, publication as a preliminary note may be justified.)

Scientists also have an obligation to publish their research results in a timely manner. Unpublished research results constitute research not done in the eyes of other scientists. Unnecessary delays can result in duplication of efforts and may hinder the advancement of science. Under no circumstances should a manuscript
be submitted and then held up in the revision or page proof stage for reasons not directly related to the research—for example, because of patent considerations.

Given the “publish or perish” mentality that sometimes exists, researchers may be tempted to maximize their number of publications by publishing many short, somewhat repetitive research reports. This practice serves no useful purpose for science or the investigator. In truth, the reputation of an investigator is ultimately determined by the quality of research done over an extended time. Beginning independent investigators are often told that a research reputation can be thought of as a product of quantity times quality of published work. If only one publication appears every 10 years, they may be advised, it had better be a good one. On the other hand, a large number of low-quality publications is not of benefit to the individual or the profession.

Investigators may be tempted to publish the same material, or material only slightly different, multiple times. This practice is unethical. The manuscript should clearly describe prior work that has been done by the authors. It is the obligation of the corresponding author to inform the journal editor of any related manuscripts that have been submitted and/or published elsewhere, including preliminary communications and symposium volumes. There are no exceptions. Moreover, although the review process can be lengthy, under no circumstances should a manuscript be submitted simultaneously to multiple journals.

**What To Publish: Full Disclosure**

Unfortunately, because of space limitations, the trend in publishing research results is to provide less and less detail. Although brevity is admirable, it is important that the results be described fully and accurately. Moreover, all of the results should be reported, not just those supporting the underlying hypotheses of the research. If necessary, most journals allow the possibility of submitting supporting documentation as supplementary information. Although this material does not appear in the printed version, it is readily available online. The rule of thumb is that sufficient information should be provided so that other investigators could repeat the experiments if they so desired. The necessity for providing sufficient detail has to be balanced with the need to conserve publication space. As might be expected, considerable variation exists in practice as to what this entails. The manuscript review process plays a tempering role, balancing these two factors.

Representative data and/or calculations are an important part of any scientific presentation. Obviously, not all of the data, derivations, and calculations can be presented. It is acceptable for the “typical data and/or calculations” that are presented to be among the best, but all the data should be included in the analyses. The reproducibility of the results is an implicit assumption for published work. However, first-rate research often involves difficult measurements at the edge of existing methodology, and the difference between signal and noise may
be hard to distinguish. It is acceptable to report results for which this is the case, as long as the appropriate qualifications are clearly stated. A critical assessment of the research should be made by the investigator, including an error analysis. No one should be more critical of the research that is reported than the authors.

Who Are Authors?

Generally speaking, all authors of a publication should have made significant and substantial intellectual contributions to the work being reported. Unfortunately, this principle is often breached, as evidenced by manuscripts with tens, even hundreds, of authors. Some laboratories put the names of everyone in the laboratory on the published work, and some individuals put their names on every publication coming out of a laboratory, even if their participation was only nominal.

If a colleague prepared buffers or did routine computer programming, these contributions should be acknowledged, but they are not sufficient contributions for authorship. General discussion with colleagues or within research groups is rarely sufficient for inclusion in authorship. Despite some arbitrariness in defining what constitutes a significant intellectual contribution, the guiding ethical principle is clear and should be adhered to. Usually the question of authorship can be decided by discussion among the participants in the research. Occasionally, a third party may be required to adjudicate this issue. In any event, this matter should be fully resolved before submission of a manuscript.

A question that often arises concerns the order of the authors’ names. This is not really an ethical issue, and practice varies from place to place. Most often the first author is assumed to have made the major contribution to the work, and the senior and/or corresponding author is listed last. However, many variations to this theme exist, such as putting the authors in alphabetical order. In some cases, the specific contributions of each author are described. Ideally, the order of authorship should be decided amicably among the authors, but perceptions sometimes differ between the individuals involved. Authors should not become obsessed with this matter. Ultimately, a researcher’s scientific reputation rests on the totality of publications and the significance of contributions to the field.

It is often said that all authors are responsible for the entire content of a manuscript. This is a meritorious ideal, but unrealistic. Most manuscripts have multiple authors, and very often, a single author is responsible for only a portion of the work being presented. For example, the manuscript may contain a crystal structure, determined by an expert crystallographer; spectral data, determined by an expert spectroscopist; kinetic data, determined by an expert kineticist; etc. In cases such as this, a single author cannot be held responsible for all of the results presented. A more realistic assessment of what authorship implies is that each author should have read the manuscript carefully and understood the findings, but the technical responsibility is only for the area in which a given author
has the appropriate expertise. The responsibility of the corresponding author is to ensure that all authors have approved the manuscript before submission and for all subsequent revisions.

**What Went Before: Attribution and Context**

Every scientific publication must include the proper attribution of the contributions of others by appropriate referencing and the placement of results within the context of the research field.

Referencing is a complex subject (see Chapter 14 of this volume). Every reference in the field cannot be cited, or the reference list would become intolerably long. However, important ideas and experiments must be cited. The introduction and discussion sections of a manuscript should be absolutely clear as to what the work of others has contributed to the research being reported. If data are presented that have been previously published, this should be clearly indicated. Direct quotations of more than a few words should be indicated by quotation marks and referenced. Paraphrases of quotations also should be referenced. Plagiarism—taking the writings or ideas of another and passing them off as one’s own—of any type represents unethical conduct.

Occasionally, the attribution of an idea or fact may be to a “private communication” of a colleague or fellow scientist. In such cases, permission must be obtained from the individual in question before the citation is made. Reference to unpublished material should be avoided if possible because it generally will not be available to interested readers.

**Reminder:** Every manuscript must reference the contributions of others and place results in the context of the research field.

The results and conclusions sections of a manuscript should be placed within the context of the research area. What was known before the research being presented? What has this research contributed that is new and significant? It should also be clear what conclusions are based on the work presented and which are speculations. It is appropriate to speculate—in fact, this is a stimulus to the field—as long as speculations are labeled as such. In this regard, the values and judgments of the authors and current thinking appropriately come into play.

Not all attributions to previous work cite supportive data. In some cases, results under discussion may differ from previous work, or authors may make critical comments about earlier research. Differences between the work reported and previous results must be discussed and reconciled. Criticism of previous work should be presented carefully and objectively, in terms of the facts only. This is part of normal scientific discourse. Criticism should never be directed at
individuals or laboratories; it is essential to consider only the facts that have been presented.

Acknowledgments should be made to people who have assisted in the project, but not sufficiently for authorship, and to sponsoring agencies. It is also imperative to acknowledge potential conflicts of interest that may exist. For example, if the research being reported concerns drug XYZ and one of the authors has a substantial financial interest in a company that makes drug XYZ or is conducting clinical trials with drug XYZ, these facts should be explicitly stated.

What Next: After Publication

An author’s obligations do not stop with publication. If errors are found in the published work, they should be corrected with the publication of errata. If other investigators request more information or more complete data, the requests should be fulfilled without delay.

A trickier issue concerns the distribution of special materials used in the research. The rule of thumb is that the authors should be willing to provide others with a reasonable supply of special materials that have been used in the research. However, some common sense should be applied to this rule. For example, if two years have been spent cloning a specific protein and it will be used in future research, it is unreasonable to expect researchers to give this clone to competitors who are planning similar experiments. Similarly, if a complex substance has been synthesized and only a small supply is available, it would be unreasonable to expect the material to be given away. However, the publication should provide sufficient detail so that other researchers can develop the clone themselves or synthesize the compound in question. Although ethical behavior in this area is not always clear, the general rule is that all aspects of the research should be fully disclosed and reasonable assistance should be given to other researchers. Progress in science depends greatly on open communication and cooperation.

Obligations of a Reviewer

Scientific discourse depends on critical review of manuscripts before publication. (Peer review—including ethical considerations—is discussed in greater detail in Chapter 6 of this volume.) The primary obligation of reviewers is to provide a rational, objective review of the science. This requires a careful reading of the manuscript and a careful preparation of the review. The review process is anonymous for most journals, but this does not mean that the reviewer has free rein to criticize. Any criticism must be logically and objectively delineated, and it should never be directed at the authors personally. Reviewers also should place the work within the context of the field: is it a major contribution, minor contri-
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bution, or an insufficient contribution to merit publication? Promptness in carrying out reviews is important and an ethical issue. Delaying a publication could be costly to an author, especially in a competitive field. The usual golden rule applies: review with the care and speed you expect for your own manuscripts. If a reviewer cannot meet a deadline, he or she should inform the publisher as soon as possible.

Manuscripts sent to reviewers are confidential documents. Unfortunately, a significant number of reviewers interpret the word “confidential” incorrectly. Confidential does not mean that reviewers can expand the scope of confidentiality, for example, within their research groups, by including a few colleagues, and so on. Confidential documents should not be shared or discussed with anybody without the explicit consent of the journal editor, the editorial board member handling the manuscript, or both. For example, senior investigators sometimes have graduate students or postdoctorals review manuscripts. This is acceptable only if the permission of the editor or editorial board member has been obtained. In some cases, a reviewer may discuss the results with a colleague; this also is forbidden if permission has not been obtained. Although breaches of confidentiality do not usually do any harm and are not intended to do so, they are unethical and should be avoided.

If reviewers have conflicts of interest with regard to a given manuscript, the manuscript should be returned as quickly as possible to the editor. Conflicts of interest vary. Perhaps similar research is being carried out in the reviewer’s laboratory, or the reviewer may be privy to confidential information that conflicts with the results reported. Conflicts of interest can be more personal in nature: perhaps a reviewer has had personal difficulties with or is a close friend of one of the authors. When in doubt, the usual rule is not to review or read the manuscript. If you are unsure, ask the editor handling the manuscript. The editor may want your expert opinion even if some level of apparent conflict exists.

Finally, the results in a manuscript under review cannot be quoted or incorporated into a reviewer’s own research program. After the work is published, a reviewer may use the ideas and data presented (with proper attribution), but the reviewer should not do so based on the review process. Such behavior is akin to insider trading in the purchase of stocks. Although a prison term is unlikely for this breach of conduct, the ethical principle is quite clear.

Obligations as a Reader

Not all errors are found before publication by authors and reviewers; some are discovered by readers. If the errors involve serious misinterpretation or misquotation of the literature, the most straightforward procedure is to contact the author(s) directly. If this is awkward, the editor can be informed. It is not worthwhile, however, to create a fuss for nonsubstantive errors. Self-serving com-
plaints, such as not quoting the reader’s own work enough, seldom have much credibility.

In rare situations, a scientist may have evidence that published material contains falsification, fabrication, or plagiarism. It is the obligation of every scientist to report such cases immediately to the editor of the journal. Institutions receiving financial support from the National Institutes of Health and the National Science Foundation are required to have mechanisms in place to investigate such occurrences, and direct reporting to the appropriate institutional office may be more expedient. Accusations must be supported by fact, not suspicions, because academic misconduct is a serious matter with career-threatening implications. Unpleasant as this situation may be, it should not be ignored.

For the Health of Research

This chapter has emphasized the global ethics of the publication process. Ethics are not complicated, and the practices and rules are mainly common sense. Adherence to ethical standards in research and publication is not optional; rather, it is essential for the health of scientific research.
APPENDIX 1-1

Ethical Guidelines to Publication of Chemical Research

The guidelines embodied in this document were revised by the Editors of the Publications Division of the American Chemical Society in January 2000.

Preface

The American Chemical Society serves the chemistry profession and society at large in many ways, among them by publishing journals which present the results of scientific and engineering research. Every editor of a Society journal has the responsibility to establish and maintain guidelines for selecting and accepting papers submitted to that journal. In the main, these guidelines derive from the Society’s definition of the scope of the journal and from the editor’s perception of standards of quality for scientific work and its presentation.

An essential feature of a profession is the acceptance by its members of a code that outlines desirable behavior and specifies obligations of members to each other and to the public. Such a code derives from a desire to maximize perceived benefits to society and to the profession as a whole and to limit actions that might serve the narrow self-interests of individuals. The advancement of science requires the sharing of knowledge between individuals, even though doing so may sometimes entail forgoing some immediate personal advantage.

With these thoughts in mind, the editors of journals published by the American Chemical Society now present a set of ethical guidelines for persons engaged in the publication of chemical research, specifically, for editors, authors, and manuscript reviewers. These guidelines are offered not in the sense that there is any immediate crisis in ethical behavior, but rather from a conviction that the observance of high ethical standards is so vital to the whole scientific enterprise that a definition of those standards should be brought to the attention of all concerned.

We believe that most of the guidelines now offered are already understood and subscribed to by the majority of experienced research chemists. They may, however, be of substantial help to those who are relatively new to research. Even

The ethical guidelines are also available in their most recent version on the Web at https://paragon.acs.org.
well-established scientists may appreciate an opportunity to review matters so significant to the practice of science.

**Guidelines**

**A. Ethical Obligations of Editors of Scientific Journals**

1. An editor should give unbiased consideration to all manuscripts offered for publication, judging each on its merits without regard to race, religion, nationality, sex, seniority, or institutional affiliation of the author(s). An editor may, however, take into account relationships of a manuscript immediately under consideration to others previously or concurrently offered by the same author(s).

2. An editor should consider manuscripts submitted for publication with all reasonable speed.

3. The sole responsibility for acceptance or rejection of a manuscript rests with the editor. Responsible and prudent exercise of this duty normally requires that the editor seek advice from reviewers, chosen for their expertise and good judgment, as to the quality and reliability of manuscripts submitted for publication. However, manuscripts may be rejected without review if considered inappropriate for the journal.

4. The editor and members of the editor’s staff should not disclose any information about a manuscript under consideration to anyone other than those from whom professional advice is sought. (However, an editor who solicits, or otherwise arranges beforehand, the submission of manuscripts may need to disclose to a prospective author the fact that a relevant manuscript by another author has been received or is in preparation.) After a decision has been made about a manuscript, the editor and members of the editor’s staff may disclose or publish manuscript titles and authors’ names of papers that have been accepted for publication, but no more than that unless the author’s permission has been obtained.

5. An editor should respect the intellectual independence of authors.

6. Editorial responsibility and authority for any manuscript authored by an editor and submitted to the editor’s journal should be delegated to some other qualified person, such as another editor of that journal or a member of its Editorial Advisory Board. Editorial consideration of the manuscript in any way or form by the author-editor would constitute a conflict of interest, and is therefore improper.

7. Unpublished information, arguments, or interpretations disclosed in a submitted manuscript should not be used in an editor’s own research except with the consent of the author. However, if such information indicates that some of the editor’s own research is unlikely to be profitable, the editor could
ethically discontinue the work. When a manuscript is so closely related to the current or past research of an editor as to create a conflict of interest, the editor should arrange for some other qualified person to take editorial responsibility for that manuscript. In some cases, it may be appropriate to tell an author about the editor’s research and plans in that area.

8. If an editor is presented with convincing evidence that the main substance or conclusions of a report published in an editor’s journal are erroneous, the editor should facilitate publication of an appropriate report pointing out the error and, if possible, correcting it. The report may be written by the person who discovered the error or by an original author.

9. An author may request that the editor not use certain reviewers in consideration of a manuscript. However, the editor may decide to use one or more of these reviewers, if the editor feels their opinions are important in the fair consideration of a manuscript. This might be the case, for example, when a manuscript seriously disagrees with the previous work of a potential reviewer.

B. Ethical Obligations of Authors

1. An author’s central obligation is to present an accurate account of the research performed as well as an objective discussion of its significance.

2. An author should recognize that journal space is a precious resource created at considerable cost. An author therefore has an obligation to use it wisely and economically.

3. A primary research report should contain sufficient detail and reference to public sources of information to permit the author’s peers to repeat the work. When requested, the authors should make a reasonable effort to provide samples of unusual materials unavailable elsewhere, such as clones, microorganism strains, antibodies, etc., to other researchers, with appropriate material transfer agreements to restrict the field of use of the materials so as to protect the legitimate interests of the authors.

4. An author should cite those publications that have been influential in determining the nature of the reported work and that will guide the reader quickly to the earlier work that is essential for understanding the present investigation. Except in a review, citation of work that will not be referred to in the reported research should be minimized. An author is obligated to perform a literature search to find, and then cite, the original publications that describe closely related work. For critical materials used in the work, proper citation to sources should also be made when these were supplied by a nonauthor.

5. Any unusual hazards inherent in the chemicals, equipment, or procedures used in an investigation should be clearly identified in a manuscript reporting the work.

6. Fragmentation of research reports should be avoided. A scientist who has done extensive work on a system or group of related systems should organize
publication so that each report gives a well-rounded account of a particular aspect of the general study. Fragmentation consumes journal space excessively and unduly complicates literature searches. The convenience of readers is served if reports on related studies are published in the same journal, or in a small number of journals.

7. In submitting a manuscript for publication, an author should inform the editor of related manuscripts that the author has under editorial consideration or in press. Copies of those manuscripts should be supplied to the editor, and the relationships of such manuscripts to the one submitted should be indicated.

8. It is improper for an author to submit manuscripts describing essentially the same research to more than one journal of primary publication, unless it is a resubmission of a manuscript rejected for or withdrawn from publication. It is generally permissible to submit a manuscript for a full paper expanding on a previously published brief preliminary account (a “communication” or “letter”) of the same work. However, at the time of submission, the editor should be made aware of the earlier communication, and the preliminary communication should be cited in the manuscript.

9. An author should identify the source of all information quoted or offered, except that which is common knowledge. Information obtained privately, as in conversation, correspondence, or discussion with third parties, should not be used or reported in the author’s work without explicit permission from the investigator with whom the information originated. Information obtained in the course of confidential services, such as refereeing manuscripts or grant applications, should be treated similarly.

10. An experimental or theoretical study may sometimes justify criticism, even severe criticism, of the work of another scientist. When appropriate, such criticism may be offered in published papers. However, in no case is personal criticism considered to be appropriate.

11. The coauthors of a paper should be all those persons who have made significant scientific contributions to the work reported and who share responsibility and accountability for the results. Other contributions should be indicated in a footnote or an “Acknowledgments” section. An administrative relationship to the investigation does not of itself qualify a person for coauthorship (but occasionally it may be appropriate to acknowledge major administrative assistance). Deceased persons who meet the criterion for inclusion as coauthors should be so included, with a footnote reporting date of death. No fictitious name should be listed as an author or coauthor. The author who submits a manuscript for publication accepts the responsibility of having included as coauthors all persons appropriate and none inappropriate. The submitting author should have sent each living coauthor a draft copy of the manuscript and have obtained the coauthor’s assent to coauthorship of it.
12. The authors should reveal to the editor any potential conflict of interest, e.g., a consulting or financial interest in a company, that might be affected by publication of the results contained in a manuscript. The authors should ensure that no contractual relations or proprietary considerations exist that would affect the publication of information in a submitted manuscript.

C. Ethical Obligations of Reviewers of Manuscripts

1. Inasmuch as the reviewing of manuscripts is an essential step in the publication process, and therefore in the operation of the scientific method, every scientist has an obligation to do a fair share of reviewing.

2. A chosen reviewer who feels inadequately qualified to judge the research reported in a manuscript should return it promptly to the editor.

3. A reviewer (or referee) of a manuscript should judge objectively the quality of the manuscript, of its experimental and theoretical work, of its interpretations and its exposition, with due regard to the maintenance of high scientific and literary standards. A reviewer should respect the intellectual independence of the authors.

4. A reviewer should be sensitive to the appearance of a conflict of interest when the manuscript under review is closely related to the reviewer’s work in progress or published. If in doubt, the reviewer should return the manuscript promptly without review, advising the editor of the conflict of interest or bias. Alternatively, the reviewer may wish to furnish a signed review stating the reviewer’s interest in the work, with the understanding that it may, at the editor’s discretion, be transmitted to the author.

5. A reviewer should not evaluate a manuscript authored or coauthored by a person with whom the reviewer has a personal or professional connection if the relationship would bias judgment of the manuscript.

6. A reviewer should treat a manuscript sent for review as a confidential document. It should neither be shown to nor discussed with others except, in special cases, to persons from whom specific advice may be sought; in that event, the identities of those consulted should be disclosed to the editor.

7. Reviewers should explain and support their judgments adequately so that editors and authors may understand the basis of their comments. Any statement that an observation, derivation, or argument had been previously reported should be accompanied by the relevant citation. Unsupported assertions by reviewers (or by authors in rebuttal) are of little value and should be avoided.

8. A reviewer should be alert to failure of authors to cite relevant work by other scientists, bearing in mind that complaints that the reviewer’s own research was insufficiently cited may seem self-serving. A reviewer should call to the editor’s attention any substantial similarity between the manuscript under
consideration and any published paper or any manuscript submitted concurrently to another journal.

9. A reviewer should act promptly, submitting a report in a timely manner. Should a reviewer receive a manuscript at a time when circumstances preclude prompt attention to it, the unreviewed manuscript should be returned immediately to the editor. Alternatively, the reviewer might notify the editor of probable delays and propose a revised review date.

10. Reviewers should not use or disclose unpublished information, arguments, or interpretations contained in a manuscript under consideration, except with the consent of the author. If this information indicates that some of the reviewer’s work is unlikely to be profitable, the reviewer, however, could ethically discontinue the work. In some cases, it may be appropriate for the reviewer to write the author, with copy to the editor, about the reviewer’s research and plans in that area.

11. The review of a submitted manuscript may sometimes justify criticism, even severe criticism, from a reviewer. When appropriate, such criticism may be offered in published papers. However, in no case is personal criticism of the author considered to be appropriate.

D. Ethical Obligations of Scientists Publishing outside the Scientific Literature

1. A scientist publishing in the popular literature has the same basic obligation to be accurate in reporting observations and unbiased in interpreting them as when publishing in a scientific journal.

2. Inasmuch as laymen may not understand scientific terminology, the scientist may find it necessary to use common words of lesser precision to increase public comprehension. In view of the importance of scientists’ communicating with the general public, some loss of accuracy in that sense can be condoned. The scientist should, however, strive to keep public writing, remarks, and interviews as accurate as possible consistent with effective communication.

3. A scientist should not proclaim a discovery to the public unless the experimental, statistical, or theoretical support for it is of strength sufficient to warrant publication in the scientific literature. An account of the experimental work and results that support a public pronouncement should be submitted as quickly as possible for publication in a scientific journal. Scientists should, however, be aware that disclosure of research results in the public press or in an electronic database or bulletin board might be considered by a journal editor as equivalent to a preliminary communication in the scientific literature.