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Ethics For and Responsibilities of Authors, Reviewers and Editors in Science

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Character is doing what is right when nobody's looking.
Representative J. C. Watts, National Journal, 18 April 1998:869.

ABSTRACT.—Science is made of building blocks, that is, one piece of knowledge leads to or combines with another piece ad infinitum. Consequently, for the process of science to work, everyone involved must be able to count on everyone else to conduct their work in a straightforward manner involving no deception. As scientists, authors, reviewers and editors have the responsibility to the global scientific community to help train the next generation of scientists to recognize the differences between ethical and unethical behaviors. To assist in this process discussions are included of the obligations and limitations of authors, reviewers and editors. Also, included are discussions concerning usage of copyrighted materials, advocacy, coauthorship, conflicts of interest, publishing rights and responsibilities and characteristics of a good review. To assist understanding of these concepts, are a series of hypothetical Case Studies intended to allow students of science to consider, discuss and challenge their thinking related to the integrity of research and publishing in science.

INTRODUCTION

Science is defined as the ''accumulated and accepted knowledge that has been systematized and formulated with reference to the discovery of general truths or the operation of general laws,'' but it is also ''a branch of study that is concerned with observation and classification of facts and especially with the establishment of verifiable general laws chiefly by induction and hypotheses'' (Webster's Third New International Unabridged Dictionary). These two definitions give the impression that science basically is stationary—that after a ''law'' or ''truth'' initially is established it never changes. However, as you read the scientific literature, you come to understand that science is an ever-evolving enterprise. As everything is open to question in science, what is considered a general truth or law or an accepted classification of facts at one point-in-time may not be so at some later point-in-time because of gains in knowledge. This means that no knowledge in science is ''carved in stone.'' Further, what else could affect how a so-called general truth or law is viewed by scientists? Whether we want to admit it or not, we all are products of the societies and cultures in which we have lived. So, when we begin a scientific endeavor we take along a lot of ''hidden baggage'' of preconceived ideas and ways of viewing things.

For most of the past centuries in which scientific research has been conducted, world-wide communication within the scientific community was protracted. Long-distance telephone service, which is at best an awkward method of conveying new ideas, and e-mail communication have only a short history (Clark, 2007:305–308). And, travel to gatherings of scientists to present new ideas or expansions of established ideas until recent decades was time-consuming and possibly hazardous. Many scientists working in isolation made remarkable discoveries for which they themselves may or may not have understood the ramifications or applications of their discovery. Also, a discovery may be so far advanced of the current state of knowledge that the scientific community may choose to ignore it, or simply decide that it is an utterly foolish idea that could not possibly be correct because, the idea brings too many entrenched ideas into question (Lindeman, 1942; Cook, 1977;

Colborn *et al.*, 1996:198–199; C. Woese as discussed in Friend, 2007). So, for most of the history of scientific research and development, unless a scientist was located in or near a large metropolitan area or was well known, it was difficult to disseminate knowledge. Commonly, a lesser known scientist would send a manuscript to a better known scientist asking him to present it at a meeting of scientists, or, would ask for assistance in having the manuscript published. Finally, since the mid-1990s, the Internet has revolutionized the flow and exchange of information making it as convenient and easy as typing a few keywords in a search engine.

In an ideal world, containing a small scientific community, everyone would follow priority of an idea as to which individual(s) should receive credit for it. However, not only do we not live in an ideal world, but thousands of scientists live in many countries across the earth. And, although in more recent decades many of us gather at scientific conferences to discuss topics within our areas of interest or expertise or present talks or posters telling attendees of our current research, not everyone can attend these conferences. So, the best manner in which we can communicate new information, ideas or a different way of thinking is by publishing in scientific journals (print or electronic) or books. Thus, priority, *i.e.*, the individual who receives credit for the idea, is based on who publishes an idea first.

For the process of science to work, everyone involved must be able to count on everyone else to conduct their work in a straightforward manner involving no deception (Sigma Xi, 1987). This is what is meant by scientists having good ethics, integrity and character. In the ideal world, all scientists would be honest, fair, objective and sincere. However, I repeat—we do not live in an ideal world. As a result of the instances in recent decades of unethical behavior in a diverse set of professional scientific fields, many professional societies and government agencies have developed individual and communal codes of behavior based on a set of agreed-upon principles of behavior and for conducting research (Tri-council Policy Statement, 1994; Bulger *et al.*, 1995; Sigma Xi, 1999; CSE, 2006; Science Council of Japan, 2005, 2006). And, just as science is ever evolving, so are the codes of conduct constantly being refined (AAAS, 2007). Current thinking defines unethical behavior or scientific misconduct as ''. . . fabrication, falsification, plagiarism, or other serious deviation from accepted practices in proposing, [conducting], or reporting [research] results . . .'' (Parrish, 1996:6). Further, it should include ''selective use of data without making it explicit,'' ''manipulation of graphs and figures,'' ''destruction of primary data,'' and ''sabotage of others' work'' (Bostanci, 2002:1778). Consequently, ethical behavior means everyone follows ''the principles of conduct governing an individual or a profession'' (Webster's Third New International Unabridged Dictionary).

Becoming a proficient and responsible author, reviewer or editor requires much practice, considerable effort and experience, *i.e.*, profiting from one's mistakes. As scientists, we have the responsibility to the global scientific community to help train the next generation of scientists to recognize the differences between ethical and unethical behavior (Weinberg, 1978; Medawar, 1979; Panel on Scientific Responsibility and the Conduct of Research, 1992, 1993; Teich and Frankel, 1992; Committee on Science, Engineering, and Public Policy, 1995; Johnson, 2007; Appendices I, II, III). ''Incidents of dishonesty in science will continue to occur until senior scientists understand that if there is unethical behavior in their laboratories, it is they who are personally responsible, they who share the guilt, and they who cannot evade the point'' (Nobel laureate Rosalyn S. Yalow, 1993, as cited in Sigma Xi, 1999:29). Consequently, practicing scientists must be willing to help the next generation of aspiring scientists to understand the need to behave in an ethical manner.

AUTHORS

Authors are the cornerstones of science. If not for authors, knowledge gained while conducting research would travel no farther than the researcher and maybe a few friends. There would be no need for journals and books or reviewers and editors. There would be no advancement of knowledge imparted across generations of individuals who have an insatiable curiosity to know and understand more about the world in which they live. However, conducting good research does not automatically make someone a good author. Both enterprises require much guidance by mentors, due diligence, practice and experience as there are many pitfalls to be avoided (Sigma Xi, 1999; CSE, 2006; Appendix I).

Sometimes the state of knowledge comes to a point, *i.e.*, is ripe, where a new way of thinking or a new concept comes to the minds of more than one individual simultaneously. Thus, to establish priority for a unique idea that may have a significant impact on a field of science, either it should be presented to a large enough audience that priority is unquestionable or be accepted for publication before it is disseminated. If the former, a manuscript incorporating the unique idea should be submitted for publication soon after the conference to prevent the new idea from being incorporated into the next step in the evolution of knowledge without appropriate acknowledgment (Couzin, 2007:744).

Obligations of authors to science.—As an author you must be straightforward and honest regarding your research, *e.g.*, hypotheses tested, laboratory procedures and data collection, handling and analyses. Authors should not publish the results of a research project in *least publishable units*. More than one paper can result from a research project; however, each paper must contain a reasonable unit of knowledge (Angell, 1983; Wikipedia, 2007).

Samples on which research is based must be retained, or placed into permanent long-term care. These samples include, but are not limited to, raw data, animal or plant tissues stored in a −80 C freezer or liquid nitrogen, dried stomach contents, voucher specimens (Carraway, 2007), gene sequences, field notes and taped or printed recordings.

We all have ''hidden baggage'' derived from the cultures and societies in which we have lived that provide us with a set of value judgments and ways of viewing the world. As authors, we must be aware of and guard against allowing our ''hidden baggage'' to unduly influence our research and how we report our research to the scientific community in papers and talks (Koertge, 1998). Also, graduate students need to be led to understand that acceptable behavior in the global scientific community must be as independent as possible of any particular cultural influences.

When at all possible do not reference papers that provide summarizations, *i.e.*, based on literature searches, to provide the necessary background information and support needed for your research. All human beings are fallible; thus, mistakes in interpretation or misunderstandings of what someone has written occur in the secondary literature. If everyone used the primary literature, mistakes could be reduced and their proliferation into future publications avoided. After all, if there is to be a mistake in a manuscript, it is better to have made it yourself than to have it be the result of falsely assuming the author who wrote the summary paper was careful.

Not all papers published in scientific journals or books are cited or accessible on the Internet (Warnick, 2007). Much primary literature available in university libraries may never appear in a list produced by an Internet search engine. Never presume that the first information found in Internet searches is sufficient. With diligent searching, perhaps more

information will be found that supercedes the initial information located. Finally, many times it is necessary to refer to scientific literature published 50, 100 or more y earlier. However, on the Internet many journals list their tables of contents only back to 1995 or 1985. As a result, much of the development of fields in science is unavailable on the Internet no matter how diligent a search an investigator performs.

Acknowledging contributions to a research project always should be given where credit is due (Cohen, 1995; Rose and Fischer, 1995; Weltzin *et al.*, 2006). Thus, credit to individuals who provided assistance or performed part of the work on which the manuscript is based must be stated clearly.

Scientific research should be published only after going through peer review. As science is not an individual experience, we have an obligation to the scientific community and society (who ultimately pays our bills) to publish our research findings in the most honest, open and forthright manner. All research materials and data should be available on demand to other scientists for reexamination or reanalysis (Lemen, 1978; Carraway *et al.*, 1996). However, the scientist who collects the data always should have first use of those data.

Finally, as science is a self-correcting enterprise most errors that occur in scientific publications, whether the result of honest error, misinterpretation, carelessness or unethical behavior, usually are corrected by further research—whether by the same researchers or others (*e.g.*, Talent *et al.*, 1988; O'Donnell, 2007; Patsopoulos *et al.*, 2007; Swanson and Kyle, 2007; Williams and Scribner, 2007). As a part of this self-correcting enterprise, anyone who is an author and scientist always must be willing to correct errors in their publications that affect the results of their research and potentially that of others just as soon as the error is discovered (Chang *et al.*, 2006; Miller, 2006, 2007). This is the true hallmark of a scientist.

Fair usage.—This is the means by which an author legally incorporates in a manuscript statements published in someone elses paper. These statements either are restated or exactly quoted. Restating published statements involves the process of paraphrasing, *i.e.*, understanding information contained in statements in a publication well enough to convert it into your own words. A citation for the source of the rewritten statements must be included. When published statements are quoted, they must be presented in quotation marks and the citation (including the page number on which the statements appeared) of the original publication provided. The published statements must be quoted exactly, errors and all. However, it is acceptable to insert words in brackets for added clarity, to insert '[sic]' following misspellings, and insert an ellipsis (. . .) to shorten the quotation as long as the original meaning of the quotation remains unchanged. Contrary to the opinion of some authors, simply deleting some punctuation and changing a word or two from the original or including published statements verbatim, then treating them as your own, is not acceptable fair usage of information presented in the original publication. This is plagiarism, *i.e.*, the process of taking statements from a publication, including them in your own manuscript and treating them as original (example: Godin, 1982 from Verts, 1967).

Use of copyrighted materials.—Usually figures or photographs published in journal articles or books are owned by either the author, illustrator or publisher. This means that the owner holds the copyright for the figure or photograph. Thus, *if you are not the holder of the copyright, you do not have the right to use the published figure or photograph* (*i.e.*, by scanning or photographing) *without expressed permission of the copyright holder.* There are no acceptable excuses for violating a legal copyright. Consequently, if you are unwilling to take the time, energy and effort required to obtain permission from the copyright holder for reasonable

usage of the figure or photograph in question, then do not use it. This means that either you produce original illustrations or redraw illustrations included in a publication. However, for the latter, you still are obligated to include an explicit statement ''. . . in the figure legend stating 'Figure [drawing(s), map, or whatever is appropriate] modified (or redrawn) from (*insert citation of publication from which the figure was derived*)' '' (Carraway, 2007:422).

Advocacy.—To push for a certain outcome, perspective or way of doing things is acceptable. As a scientist matures, it would be difficult not to develop strong opinions concerning how something should be done and sometimes want to push hard for the desired outcome. However, advocacy and scientific research are two distinct processes that never should be confused. Scientific research may be used as supporting evidence for advocating a particular stance; however, scientific research never should be conducted to prove a particular stance.

Advocacy also can take on indirect forms, such as, authors saying something 'might be' in one publication then treating it as fact with good basis in a second publication with the first used as the supporting evidence. Another indirect form of advocacy is using a questionable method in one publication then treating it as a valid method in a second publication (Gitzen, 2007).

Coauthorship.—Developing ideas, hypotheses and conducting research to test or examine them, analyzing data, writing a manuscript and publishing as a sole author can be a satisfying experience. However, being a sole author on a scientific paper is not an easy task; it is all the more difficult if there are multiple authors. This is because every author on a multi-authored paper is responsible for all the work included by other authors of the manuscript—not just their portion of the manuscript (Weltzin *et al.*, 2006).

Some research projects are so involved, or require expertise demanding a great deal of time to develop, that it behooves many people to collaborate. These individuals divide the workload involved in conducting the research, jointly produce and revise a manuscript before submitting it to a journal for consideration for publication, then jointly receive the praise (or condemnation) for the research (Weltzin *et al.*, 2006; Shrum *et al.*, 2007; Stanford, 2007; Wuchty *et al.*, 2007; Appendix I). However, if work involved in the research is produced by many different individuals or groups in discrete units, it is impossible for every author to know the details of all aspects of the research reported in the manuscript. For such situations, a section entitled 'Authorship Responsibility' placed after the acknowledgments section should be included in the manuscript. In this added section would be described who did which aspects of the research. In this manner, not only do authors receive full credit for their aspect of the research, but if a problem were to arise, condemnation could be assigned properly (Rennie *et al.*, 1997).

Many such collaborative efforts last only as long as one research project. Others last for a series of research projects related to a central topic, concept or idea. If you are most fortunate, an individual will come along that enjoys conducting research with you just as much as you do with them. These research relationships can last a lifetime and be most fulfilling experiences. The result is that you both find your joint work is of better caliber and more far reaching in science than either of you ever could have accomplished alone (Wuchty *et al.*, 2007).

A special category of authorship exists between professors and their students. It is not acceptable, for a professor whose name will appear on the byline of a manuscript with a student, to allow the student to submit a manuscript that is not the best it can be with the excuse that it will be a learning experience for the student. Not only do the professors have

all the normal authorship obligations relative to production of a manuscript, but the professor also should play the role of mentor. In this instance, being a mentor means guiding the student to understand what is required of a manuscript for it to be publishable in a scientific journal, what characteristics will enhance the probability of a manuscript being accepted for publication and that the manuscript must meet all ethical standards for their field of science. This is the learning experience to which every student who desires to become a productive, contributing member of the scientific community should have access.

If a person is paid to perform some service related to the research, *i.e.*, conduct field work, collect or analyze data, produce figures or genetic sequences, among many others, ordinarily they do not have the right of coauthorship. However, there are times when a person being paid to perform a service does much more than just the basics of completing their assigned task. That is, they contribute so much to the research in terms of grant proposal development, establishment of research protocols, data collection or interpretation of results that they have as much right to be an author on a manuscript as anyone else involved in the research project (Weltzin *et al.*, 2006).

Be cautious of individuals that expect to be guest authors on your manuscript (Zen, 1988; Weltzin *et al.*, 2006). When someone provides a peer review of your manuscript, whether asked by you or an editor, they **do not** have the right to demand coauthorship *no matter how much time and effort they put into the review.* Also, individuals who provided a piece of equipment, access to equipment, laboratory space, a field camp, a computer, and such, do not qualify for coauthorship. Finally, if your coauthor expresses an interest in publishing a paper resulting from your research collaboration in a language you do not read, you must take the time and make the effort to find an impartial person to translate the manuscript into a language you can read. This will allow for confirmation of the contents of the manuscript.

Limitations of authors.—As an author you do not have the right to falsify, fabricate or eliminate 'inconvenient' data (Normile, 2007). Nor do you have the right to not tell the whole truth, whether by omission or commission, regarding how research was conducted. When producing figures for manuscripts do not delete outliers or anomalous data points simply because they are inconvenient, even if other authors do so or statistical software programs allow such manipulations. Also, there is a limit as to how much manipulation of photographs, X-rays or graphs is acceptable (Couzin, 2006).

Statistical results must be presented in a straightforward manner so they cannot be misconstrued—not tweaked or fiddled with to give a false impression (Huff, 1993). Further, do not assume that just because statistical software on your computer provides a result that the result is correct (Chang *et al.*, 2006). Computers, and the analytical software they contain, are wonderful for saving considerable time and labor; however, they are fallible. This is because computers and software they contain are the products of fallible human beings. Thus, when results of an analysis do not seem right, or someone questions the results as ''seeming too good to be true'' or ''that seems strange'' or ''that does not make biological sense,'' do not just dismiss these feelings or comments as irrelevant. Authors always should be willing to go back, rethink their data, how they were handled and reconsider the results of analyses. This could save the embarrassment of having to publish a retraction of a paper in a journal. Also, contrary to the belief of some individuals, negative findings can be just as valuable as positive findings. Thus, when your data negatively impact a proposed hypothesis this should be addressed, not ignored.

Conflict of interest.—We must always be aware of undue influences on our research. This means, do not allow your ties with a particular person, company, government research

agency or grant provider to cause you to ''adjust'' research results to match their agendas or expectations.

Publishing rights.—Authors have the right of first publication related to data they are responsible for collecting—*no one has the right to tell an author otherwise.* Data sets can be reanalyzed many times to address many ideas and hypotheses with a distinct publication resulting from each reexamination. For example, data collected on a community of mammals may result in publications on use of available food resources, dispersal of the various types of animals, use of the habitat, offsetting of reproductive seasons, etc. However, it is unacceptable to merely modify the text and supporting materials of a manuscript and republish the paper in multiple journals on the premise you are trying to reach different audiences (Appendix I). This is called duplicate publication (Service, 2002). If you believe your manuscript should be read by a wide audience, submit it to a widely distributed journal.

When submitting a manuscript to a journal for consideration for publication, the cover letter to the managing editor always should contain a statement that ''the manuscript is not being considered simultaneously for publication in another outlet'' (Carraway, 2007:422). Despite having written such a statement, some authors still simultaneously submit their manuscripts to two journals. This is unethical behavior.

Presently, a limited number of scientific journals are publishing manuscripts online (with the belief this allows scientists quicker access to information), then on paper a few months later. This suggests the question: ''do you cite the online form just until the paper copy is published, then, just cite the paper copy?'' Certainly, to cite both simultaneously is unacceptable and a form of duplicate publication. However, within some segments of the global scientific community is the opinion that after a manuscript has appeared online, that subsequently being printed on paper automatically is considered duplicate publication. Certainly, as more journals begin publishing papers through both avenues, discussion as to when to cite each and whether this constitutes duplicate publication will come under greater scrutiny. In the meantime, authors should consult the editor of the journal to which they plan to submit a manuscript to determine the citation style used when citing papers that appear both online and in print.

Publishing online.—Circumspection is needed as to whether a manuscript will be published in limited-access online journals. Will papers published in these journals still be available to readers 10, 50 or 100 y from now? Who is to know? Authors have the responsibility to ensure that knowledge contained in their publications is available to researchers in the future, *i.e.*, that knowledge will not be lost and have to be regained. As knowledge in science evolves from one idea leading to another, the potential lack of permanence for material accessible only on the Internet should be of serious concern not only for authors but for all scientists.

In 1991, a website was initiated that ultimately became the open-access archive and journal called arXiv (http://arXiv.org/). Its goal was a fee-free scientific arena with equal access and equal dissemination of knowledge. Originally, the idea was to maintain preprints of papers on the site for a limited time span. However, almost immediately it became apparent that users of the site did not want any papers deleted. Thus, to avoid copyright infringement issues, the site transformed itself into a place for papers not published in print journals, but still adhering to the peer-review philosophy. Currently, arXiv includes only the newest version of a paper; thus, always it is clear as to which is the definitive version of a paper. And, all supplementary materials for papers also are equally available. Furthermore, their intent is that all papers ever published on the arXiv site will be accessible fee-free in

perpetuity for anyone with a computer and Internet access (J. Weiskoff, arXiv administrator, pers. comm. 27 Feb. 2008).

Following the lead of arXiv, a number of other open-access web-based sites have appeared over the last 15 y. The philosophy behind such open-access archives and journals ''. . . is a global, decentralized, massively open, democratic and non-hierarchal intellectual world where the presentation of ideas and theories is not constrained by fixed forms but, rather, is fluid and interactive, organic and evolving'' (Judson, 2004:339).

Obligations of the author to the editor.—When submitting a manuscript, do not think that a draft of a manuscript is sufficient because the reviewers and editors will rewrite it for you. Or, that a manuscript can be rewritten when a galley proof is received. Either action is a waste of the precious limited time of editors and reviewers and money that publishers have to apply to the process of publishing scientific manuscripts.

When revising a paper, authors always must be willing to consider comments made by reviewers and the editor that accompany the marked manuscript. This is not to say that an author must comply with each and every suggestion. However, you must be reasonable regarding which suggestions are not followed. Not following a suggestion simply because you believe nothing in the manuscript needs to be changed, you do not feel like making the changes or your time is better spent doing other things is unacceptable. No paper ever has been published that was not improved with the assistance of the reviewers and editor. Finally, you must document your reasons for not following suggestions in the cover letter that accompanies the revised manuscript.

REVIEWERS

All scientists have an obligation to the global scientific community to provide peer reviews for manuscripts of fellow scientists to ensure that the best possible caliber of research is published in scientific journals (CSE, 2006; Perrin, 2008). It is only through the process of peer review that the best manuscripts are published. After all, if every manuscript submitted to scientific journals for consideration for publication were to be published, all of us would be crushed under an avalanche of paper (electronic or print). In this day and age of fast communications, editors should ask if you are willing to provide a peer review for a particular manuscript before it is sent. That is the appropriate time to decline to provide a peer review. You have the right to tell the editor ''Sorry, but at this time I simply am not able to provide a review of the manuscript.'' No excuse needs to be provided.

Reasonable reasons for refusing to review a manuscript include: a conflict of interest, getting ready to conduct field work, already have three manuscripts to review, going on vacation for a month, in poor health and last, but not least you simply do not feel competent to review the subject matter of the manuscript. When you agree to review a manuscript, you are obligated to provide the review (Appendix II). It is wrong to receive a manuscript you have agreed to review then do nothing, *i.e.*, just set the manuscript on a desk and ignore it, say nothing to the editor about it or never respond to inquiries from the editor regarding the manuscript. It is better to decline to review a manuscript than to just let it sit on a desk knowing that the editor is going to start harassing you regarding the promised review at some point in the future and that authors (*i.e.*, your fellow scientists) are waiting impatiently for return of their manuscript. Finally, for the peer review process to work effectively, scientists must be willing to be reviewers as well as authors.

Conflict of interest.—There are circumstances for which scientists should refuse to review a manuscript, *e.g.*, when the manuscript in question is written by one of your students, you supervised the research, there is a continuing discord between you and the author or one of

the authors is in your department (Appendix II). Additionally, editors should be informed if you already have reviewed the manuscript for the author or another journal. To have a conflict of interest is neither good nor bad, it just is; however, every effort should be made to avoid even the appearance of impropriety. Thus, when reviewers are honest concerning any possible conflict of interest, no one will find fault with their behavior.

Obligations of a reviewer to the author.—As a reviewer you are obligated to provide an unbiased, critical, constructive review of a manuscript you receive. The comments should assist authors, when revising their manuscript, to produce the best quality manuscript possible to be placed in the permanent scientific record.

The idea of whether or not to reveal your name on a peer review can be a difficult decision. If you are a tenured full-professor no author, no matter how acrimonious, can harm your publishing career. However, it is possible that an author who feels offended by a peer review could provide a bad review of a grant proposal submitted by that reviewer just to ''even the score.'' If you are a graduate student or new to an academic career, authors who consider any suggestion for change to their manuscript as a personal affront potentially could harm your career. Unless or until you feel confident in your professional standing, care should be taken as to when to divulge your name on a peer review. Many people argue that a reviewer's name always should be divulged, that there should be no exceptions. Others argue that anonymity is what makes the peer review process work. However, whether or not to divulge your name should be considered a personal decision that only the reviewer has the right to make.

Obligations of a reviewer to the editor.—Editors receive hundreds of manuscripts a year submitted by authors hoping to have their manuscripts published. They depend on reviewers to provide their opinion as to whether or not a manuscript should be published in the journal to which it was submitted; however, such comments never should be addressed to the author(s). Also, comments regarding the manuscript must be returned to the editor in timely fashion. Usually, this means within 3–4 wk after receipt of the manuscript. If this time frame is not possible, let the editor know before agreeing to review the manuscript. This will allow the editor to decide if this delay is acceptable, or if they should contact someone else to provide a peer review.

Obligations of a reviewer to science.—The first obligation to science is to assist authors in producing the best quality manuscripts to be placed in the permanent scientific record. The only other obligation is to assist the editor in making a decision regarding whether to accept or reject a manuscript.

Limitations of a reviewer.—Upon receipt of a manuscript for review, it may not be discussed with anyone other than the editor or person who sent it. *It must be kept confidential.* However, if upon receipt of a manuscript you decide that one of your graduate students or a department colleague would be a better reviewer, **do not** just hand it to them. First, you must contact the editor who sent the manuscript, explain your opinion and receive permission from the editor for the other person to review the manuscript. Also, no matter how much effort you put into reviewing the manuscript, you **do not** have the right to demand coauthorship of any manuscript you review. Finally, no comments should be made in a review that do not directly apply to the manuscript being reviewed. This means that as a reviewer you may not make derisive or insulting remarks regarding the author(s) or their research.

Characteristics of a good review.—Learning to write a good review is no easy task; it takes practice, time and a willingness to expend the energy to provide a thorough and fair review (Wilson, 2002; Zucker, 2008). The manuscript must be read in its entirety, *i.e.*, from the title to the last word of the literature cited or appendices and all figure captions and tables.

Always think in terms of the type of review you as an author would like to receive for a manuscript. There are individuals who believe that reviewers should limit their efforts to the text of manuscripts—the remainder being the responsibility solely of the author and copy editors. I disagree. The quality of every manuscript is improved, and fewer mistakes are published, when many sets of eyes give consideration to all aspects of a manuscript.

It is the obligation of reviewers to determine if a manuscript is based on good science, contains sufficient quantities of good quality data, is written clearly with good grammar and syntax and all appropriate literature is cited. It is appropriate to mark typographical errors, undefined acronyms or jargon, overuse of contrived acronyms and errors in grammar and syntax.

For tables containing columns or rows of numbers that must add to some specific total, verify that indeed the arithmetic is correct. While reading the manuscript, any time a figure or table is referenced, refer to the figure or table to verify that everything matches and that the data are supportive of what is written. Be sure there is no duplication of data between figures and tables. When examining figures, consider if they are all necessary, more are needed or may they be combined into one? The same considerations apply to tables (Carraway, 2007).

When figures are reduced to size for the published page of the intended journal, will all lettering be legible and symbols and lines clear? Or, do any of them need to be enlarged for the sake of clarity? You, as a reviewer, should consider these questions.

Compare citations in the text and captions and footnotes of figures and tables with those listed in the literature cited. More errors are made in scientific manuscripts related to the cited literature than from any other part.

EDITORS

Some say that only fools willingly become editors. I would counter that by saying, where would we, as authors and readers of scientific publications, be without them? Most people who are editors of scientific publications volunteer their time and energy for the task. Their only pay is the satisfaction of the role they play in extending knowledge in science. Editors have the final say regarding which manuscripts make a contribution to knowledge or understanding of a subject (Appendix III). This is not to say that each published manuscript must make a profound contribution to science, but each manuscript must extend knowledge in science. Further, most editors are willing to provide extraordinary assistance to neophytes who are making every effort to produce quality manuscripts. Alternatively, editors have limited patience with established scientists who submit poorly prepared manuscripts.

Some journals have an editorial system that includes a Managing Editor who receives manuscripts from corresponding authors (Carraway, 2007), oversees production of the journal and sends manuscripts to Associate Editors who handle the peer review process. For other journals the Managing Editor sends manuscripts for peer review, with reviews either returned to the Managing Editor or the Associate Editor. Depending on the system, the Associate Editor may or may not be expected to correspond directly with authors. For scientific books, the editor of record usually handles the responsibilities of both the Managing and Associate editors.

Limitations of an editor.—You do not have the right to force your opinions on authors. A manuscript may not be rejected simply because you disagree with the reported findings or the findings conflict with current doctrine. If the authors of a manuscript that calls into

question current doctrine on some topic provide valid scientific support and clear discourse for their contentions, then the manuscript has every right to be placed in the permanent scientific record (Lindeman, 1942; Cook, 1977; Colborn *et al.*, 1996:198–199). This is one of the most important avenues for the advancement of knowledge in science (Koshland, 2007).

Obligations of the editor to authors.—Editors must behave in an aboveboard, professional manner (CSE, 2006). When a manuscript is received in the editorial office, its receipt must be recorded and acknowledgment of receipt sent to the corresponding author (Carraway, 2007). The Managing Editor should send it to an Associate Editor without delay. After receipt by the Associate Editor, potential reviewers should be contacted to determine who can provide the necessary peer reviews. Then, the manuscript should be transmitted to reviewers as quickly as possible. Authors are impatient; consequently, it is important to keep track of the length of time a manuscript has been out for peer review and to pressure tardy reviewers. Upon receipt of all reviews for a manuscript, it must be edited, a decision regarding its acceptability made, and the manuscript returned to the Managing Editor or author with the reviews and editorial comments. If authors are permitted the opportunity to revise their manuscript and return it to the editor for further consideration for publication, the Managing Editor then has another opportunity to reread the manuscript. If more editing is required, it is necessary to obtain permission from the corresponding author for changes in wording of the manuscript beyond those related to the particular style of a journal. Further, the editor is responsible for keeping the author apprised of the status of their manuscript, *i.e.*, sent for peer review, official acceptance and projected publication date.

After a manuscript has been accepted for publication, eventually the corresponding author will receive a galley proof for the manuscript with forms to fill in for ordering reprints and assigning copyright to either the journal or the publisher. Papers published by authors who are U.S. Federal Government employees, and based on data collected as part of their employment may not be copyrighted. This is because technically these individuals are employed by 'the people'. As a consequence, these publications must remain in the public domain. Most, but not all, scientific publication outlets have a section on the form that assigns copyright that allows author(s) to declare they are U.S. Federal Government employees. For editors of publications that do not provide for this exception, it is wrong to demand that those authors sign the form assigning copyright to the journal or publisher. By doing so they are asking the authors to commit an illegal act.

Obligations of the editor to reviewers.—In this time of fast communications, anyone to whom you consider sending a manuscript for peer review should be contacted before the manuscript is sent. The potential reviewer must have the opportunity to refuse to review a manuscript, without prejudice. After all, an editor does not have the right to decide if a potential reviewer has the time and ability to provide the requested peer review.

Obligations of the editor to science.—Costs for publishing paper copies of journals are rising all the time. As a result, managing editors, scientific societies and publishers always are considering cost-cutting measures while facing pressures to publish even more manuscripts in issues of their journals. One method of saving space for each manuscript and allowing for the publication of more papers per issue of a journal is the use of websites to which readers must refer to obtain the supporting materials (*i.e.*, materials and methods, figures and tables) for the published papers they are reading. However, before editors, societies and publishers consider relegating pertinent supporting materials of scientific papers to online access only, they must be ready, willing and able to maintain these supporting

materials in perpetuity—not just for some arbitrary period of time. Also, access to these supporting materials must be available to anyone, not just subscribers to the journal or those readers willing to pay for the privilege of obtaining said materials. After all, knowledge in science is formed from the building blocks composed of each and every scientific paper published in journals, books and proceedings of conferences. Thus, each new generation of scientists must be able to read the scientific record of their field of interest, and that of related fields.

DISCUSSION

Science is made of building blocks, that is, one piece of knowledge leads to or combines with another piece ad infinitum. If one block is derived unethically, everything that builds on this block will be undermined because it is based on a false premise (Talent *et al.*, 1988). This is not to say that every false premise automatically has a completely destabilizing effect on a field of science; however, its impact cannot be determined or judged without the research leading to the false premise being properly redone.

Authors, reviewers and editors must answer to all of society by publishing research findings in the most honest, open and forthright manner. Trust in scientists by the lay-public rests on the concept of all scientists behaving in an ethical and upstanding manner (Gerst, 2007). Thus, ''even misconduct by one scientist can compromise public trust in the scientific community at large, as well as the intellectual activities of science in general'' (Science Council of Japan, 2006:1). Consequently, authors, reviewers and editors who do not insist on or adhere to the highest standards during the course of conducting scientific research and publication of the resulting findings erode the integrity of science for everyone (Angell, 1983). Thus, while not presuming every author is trying to cheat, or every reviewer and editor is behaving improperly, all of us must be willing to speak up when we suspect or know of inappropriate behavior on the part of authors, reviewers or editors.

Finally, knowledge of deception and unethical behavior has a propensity for being discovered and disseminated in the scientific community. Thus, when a scientist, either as author, reviewer or editor, loses their good reputation in the eyes of the scientific community, trust in the form of proper ethical behavior and integrity is seldom if ever regained.

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In the following appendices are hypothetical examples of circumstances concerning authors, reviewers and editors. These are intended to allow students of science to consider, discuss and challenge their thinking related to the integrity of research and publishing in science. Purposefully, I have refrained from stating what I believe to be the best option(s). The fundamental ethical principles that determine the correct decision(s) is(are) included in this paper. It is the function of students and their mentors to discuss these to come to the appropriate course(s) of action.

APPENDIX I. AUTHORS.

CASE STUDY I.—You submit a manuscript that contains a new technique or way of viewing an old idea to a journal for consideration for publication. It is sent for review and you receive comments back from the editor within 1–2 mo. The editor asks you to revise the manuscript based on reviewer's comments. While redoing laboratory analyses following the reviewers or editors suggestions and revising the text of the manuscript, or after the manuscript has been resubmitted to the editor, a paper appears in another journal using your innovation with the authors claiming it as their own.

OPTIONS:

1. Contact the editor of the journal in which the paper was published claiming the author was a reviewer of your manuscript, stole your idea and published quickly to claim the idea as their own. Demand the paper be retracted.
2. Contact the editor of your manuscript explaining that another paper has been published containing your new technique or way of thinking and ask if the author was a reviewer of your manuscript.

Corollary 1.—What is the consequence of asking the editor if the author of a paper was an anonymous reviewer of your manuscript?

Corollary 2.—What if the editor refuses to divulge the name of the anonymous reviewer?

3. If the answer to #2 is yes, do you with or without the support of the editor of your manuscript, contact the editor of the other journal?
4. If the answer to #2 is no, and moreover the author of the offending paper is not even at the same institution as one of the reviewers, what should you do?
5. Other options?

CASE STUDY II.—Jane, David and Mary are working on different aspects of the same project. Consequently, all three parts must be done correctly for the research to be a success, ultimately publishable and all three students to receive their graduate degrees. Once a week they gather together with their supervisor to discuss their findings and progress in the lab. Jane reports so much progress at every meeting that their supervisor sets her as an example that Mary and David should be following. After all, if Jane is getting so much more work done than Mary and David, then they must not be working hard enough. David and Mary comment they rarely see Jane in the lab so how is she getting so much work done? She states that she comes in late in the evening and commonly works during the night, so this explains why they do not see her very often.

OPTIONS:

1. Mary and David should have a private discussion regarding their concerns with their supervisor (or department head or dean).
2. Mary and David should take turns coming into the lab at various times during the late evening and night to document if Jane actually is working during those time periods.
3. Mary and David should look through Jane's lab notebooks and compare her entries with supply usage in the laboratory.
4. Other options?

CASE STUDY III.—Jim and Tom coauthored a paper in which each was responsible for a distinct portion. Following publication of the paper, Tom discovers that Jim fabricated some of his data because the actual data did not fit with his preconceived ideas.

OPTIONS:

1. Tom immediately should contact the managing editor of the journal in which the paper was published to retract the paper before confronting Jim.
2. Tom should confront Jim, demand to see the actual data, redo the analyses and determine how much impact the fabricated data had on the results and decisions reported in their paper.

Corollary.—On learning that Jim destroyed the actual data he collected because of fears of being caught fabricating data, Tom realizes he does not have the expertise, money, time or facilities to redo Jim's work. Now, what should Tom do?

3. Other options?

CASE STUDY IV.—Michael was the graduate student of Professor M. He wanted to publish a paper based on his graduate work in a language not understood by his professor and asks permission to

include the professors name on the byline. Professor M gives his permission, but does not see a translation of the paper until a year after it was published. He then finds that only part of the data included in the published paper are from the student's work. The rest of the data either are fabricated or taken from another student's research. Then, Professor M finds that Michael published several other papers that included more fabricated data and data stolen from other students' research work. He placed Professor M's name on all of these papers. Professor M talks with Michael about these problems, but Michael does not believe he did anything wrong.

OPTIONS AND CONSIDERATIONS:

1. Professor M should contact the editors of the journals in which the papers were published, explain the situation and ask that the papers be retracted.
2. If the editors refuse to retract the papers—because to do so means that within their culture they carry some responsibility for the manuscripts by having made the decision to publish the papers—what should Professor M do?
3. On hindsight, Professor M realizes he should have considered the possible cultural differences between himself and his student. What should he discuss with his other foreign graduate students?
4. What impact does Michael's inclusion of other graduate students' data have on the ability of those graduate students to publish their research results?
5. Other options?

CASE STUDY V.—Dr. G is a first-year Assistant Professor at her university. She was approached by Dr. B who is a long-established professor in her department, but who is a terrible writer, with a data set he collected before Dr. G obtained her university position. He proposes that she write a manuscript based on his data set and that she place her name on the byline of the manuscript as the junior author.

OPTIONS AND CONSIDERATIONS:

1. Dr. G should accept Dr. B's offer, write the manuscript with her name as junior author and have another publication to help gain tenure.
2. Dr. G should accept Dr. B's offer, write the manuscript and have another publication to help gain tenure. However, as she is taking responsibility for analyzing the data and writing the manuscript, her name should be listed as senior author.
3. Dr. G should suggest that Dr. B write his own manuscript and she will assist him by editing his manuscript before it is submitted to a journal. She refuses to have her name on the byline, but suggests her name appearing in the acknowledgments section would be acceptable.
4. What impact should their differences in academic standing have on Dr. G's decision?
5. Other options?

CASE STUDY VI.—Bill and Tom jointly have conducted research and coauthored and published the resulting manuscripts for many years. Bill took the lead in writing their newest manuscript, then sent it to Tom for further refinement of the writing. Tom read the manuscript and found three sentences in the introduction that obviously had some words missing. In order to clarify the point Bill was trying make, Tom examined the publications cited in the paragraph in which these three sentences appeared. Much to his dismay, he found the sentences with missing words had been copied essentially verbatim. Tom then compared the remainder of the writing in the manuscript with the text of publications cited by Bill; unfortunately, Tom found other occurrences of plagiarism in the manuscript.

OPTIONS:

1. Tom should meet with Bill. During the meeting Tom should show Bill what he found and ask for an explanation.
2. Tom should examine every paper he published jointly with Bill for which he was not responsible for writing the first draft. Then, Tom should confront Bill with his findings.

3. As there were no obvious problems concerning their joint research, *i.e.*, data collection and analyses, Tom should continue his collaborative research with Bill, but be the one to write the drafts of any future manuscripts to ensure no plagiarism again takes place in manuscripts in which his name is included on the byline.
4. Other options?

APPENDIX II. REVIEWERS.

CASE STUDY I.—You receive a manuscript for peer review that has close bearing on a student's research or your current research. In fact, it includes a new technique or modification of an old technique that would greatly improve your research, or that of one of your students. Or, worst yet, it shows that what you have reported in one of your manuscripts may be in error.

OPTIONS AND CONSIDERATIONS:

1. Return it to the editor, ignore its existence and submit your manuscript to a journal—errors and all.
2. Hold onto your manuscript and wait for this paper to be published, then revise your manuscript.
3. Hold onto your manuscript and request that the authors or editor let you know when it has been accepted for publication to allow revision and submission of your manuscript.
4. If you follow #3, what if you submit your revised manuscript to another journal in which manuscripts are published more quickly and it turns out that your manuscript still will be published before the other paper?
5. Other options?

CASE STUDY II.—You receive a request from an editor to provide a peer review for a manuscript for which you have a conflict of interest.

OPTIONS:

1. Tell the editor of the potential conflict of interest and let the editor decide if you still should be sent the manuscript for review.
2. Agree to review the manuscript without divulging the potential conflict of interest, but provide a good, unbiased critical review.
3. Agree to review the manuscript without divulging the potential conflict of interest and provide a review that makes a poor manuscript look good so you can help a friend who needs more publications to gain tenure.
4. Agree to review the manuscript without divulging the potential conflict of interest and provide a review that makes a good manuscript look poor so you can try to have the manuscript rejected for a person you believe told an editor that one of your manuscripts should not be published.
5. Other options?

CASE STUDY III.—Professor Jones receives a manuscript for peer review from the editor of Journal A. A few days later Professor Jones is sent another manuscript from the editor of Journal B. Upon examining the second manuscript, Professor Jones realizes the two manuscripts are identical, including authors, except for a few changes related to the different styles of the journals.

OPTIONS:

1. Professor Jones should call both editors, explain the situation and allow the editors to decide how to proceed.
2. Professor Jones should call the authors, tell them this is duplicate publication and insist one of the manuscripts be withdrawn.
3. Professor Jones should provide identical reviews and recommendations for publication for the manuscript to both editors.
4. Other options?

CASE STUDY IV.—John Henry, a graduate student, asked Dr. Jones, a professor in his department, to provide a review of a manuscript he had prepared for potential submission to Journal A. Dr.

Jones agrees to review the manuscript and the next day returns the marked manuscript and review back to John. John makes none of the suggested changes Dr. Jones recommended, adds Dr. Jones' name to the acknowledgments section and submits the manuscript to Journal A for consideration for publication.

OPTIONS AND CONSIDERATIONS:

1. If you were Dr. Jones, what would you say if the editor of Journal A, who knows you, called to ask if you really thought the manuscript was all right? You discover during the conversation that none of your suggested changes were made.
2. If you were Dr. Jones, what would you say to John Henry the next time he asked you to review a manuscript?
3. What comments can you make regarding John Henry's actions?
4. What might have been John Henry's motives?
5. Other options?

APPENDIX III. EDITORS.

CASE STUDY I.—A manuscript is sent for review to two people. One reviewer states the manuscript is publishable, but could be improved by following a list of provided comments and suggestions. The second reviewer states the manuscript should be rejected and provides essentially the same list of comments and suggestions to support their decision.

OPTIONS:

1. Send the manuscript out for a third review and follow the consensus of opinion.
2. If he (or she) feels confident with the material, the editor should review the manuscript and serve as the tie breaker.
3. Ask the author(s) to revise the manuscript before making a decision to accept or reject the paper.
4. Other options?

CASE STUDY II.—An editor receives a manuscript containing photographs to provide support for the reported research. Following close examination of the photographs, the editor becomes concerned that one or more has been altered significantly.

OPTIONS:

1. The editor should have a trusted individual with expertise in manipulation of photographs look at them and provide their professional opinion regarding whether or not they have been altered.
2. The editor should ask the author(s) for verification or proof that the photographs are unaltered.
3. The editor should reject the manuscript based solely on the suspicion that one or more of the photographs has been altered.
4. Other options?

CASE STUDY III.—An editor is contacted by a reviewer who states that another journal editor sent them a manuscript to review on a related subject. However, one or more of the figures are the same, but the captions accompanying the figures indicate they are supposed to be different.

OPTIONS:

1. The reviewer should contact the corresponding authors telling them that the two manuscripts contain the same figure(s). Obviously the wrong figure was included in one of the manuscripts and needs to be replaced with the correct figure.
2. The reviewer should contact the editors and allow them to deal with the problem.
3. Each editor should contact the corresponding author telling them that one of the reviewers of their manuscript also is reviewing another of their manuscripts for a different journal and the two

manuscripts contain the same figure. The author would be provided the opportunity to explain this circumstance.

4. One editor should contact the other editor and the corresponding author should be permitted the opportunity to provide an explanation of the same figure being included on both manuscripts and to correct the mistake without prejudice.
5. One editor should contact the other editor and both manuscripts should be rejected based on the same figure(s) being included in the two manuscripts.
6. Other options?