Originality, Imitation, and Plagiarism

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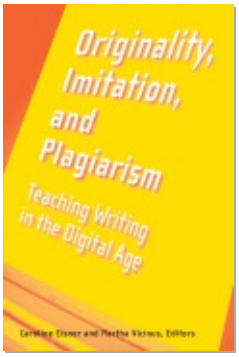

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On Ethical Issues in Publishing in the Life Sciences

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There are many complex ethical and policy issues in the diverse fields of scientific publishing. This essay deals with certain aspects of publishing in the life sciences and clinical research fields. The originality and quality of published articles and books depend ultimately on the rigor of the ideas, methods, research design, and potential impact of the findings. In biomedical research fields, journal articles carry more weight than scholarly books, partly reflecting the sense of urgency about sharing news on progress that might improve public health and medical care. Peer review is a valued feature of the publication process and is itself a complex, sometimes controversial, matter, loaded with ethical obligations.

It is instructive to examine life sciences publishing from the points of view of the scientist or group of scientists preparing the publication and choosing the target journal; the editor at the journal and the journal's peer reviewers; the research community eager for breakthrough results and yet skeptical about out-of-the-box claims; and the media and broader public seeking news about the advances of the biomedical and behavioral sciences that might have practical importance. Of course, publishing policies and practices change with time. Two current developments are new models of publishing, utilizing the Internet, and concerns that publication of certain biotechnology advances may increase the risks of bioterrorism. In the first case, the ethical issues relate to ownership of information and rights to access to information; in the second case, they concern the risks involved in providing tools that could be abused for terror or used in counterterrorism efforts, a matter sometimes called *dual-use domain.*

Author's Issues

Effective publication requires a carefully thought-through analysis by the prospective authors. They must decide how to characterize the aims of their research and determine the most important findings to be presented in the tables and figures and explained in the text. A critical decision that should orient the drafting of the paper is the choice of the most appropriate journal, both to reach the most appropriate audience for the information and to enhance the reputation of the authors. Too often authors wait until the paper is written to decide where to submit it for publication. Often authors shoot for the most prestigious journal, when the likelihood of acceptance is quite low.

Biagioli and Galison (1) highlight "the function of the author" as a standard research question in literary, legal, and gender studies, as well as in other fields. Contrasted with single-author books and scholarly works in other disciplines, scientific publications commonly have several or many coauthors, reflecting the collaborative and increasingly interdisciplinary nature of the research and the involvement at various academics levels, from students and postdoctoral fellows to principal investigators and lab directors. Who should be listed as an author, and in what order should authors be listed? The general guidance is that authorship should be limited to those who played substantial roles in the design, conduct, and analysis of the results and the writing of the manuscript. "Courtesy" coauthors, such as the head of the department or director of the laboratory, if they had no direct role in the work, and contributors of cells or reagents, are more properly acknowledged and thanked, without being made coauthors. Listed authors who played no role get unwarranted credit, and those who did the work have their roles diluted, violating ethical principles of fairness and justice. However, there is a huge zone of discretion about these credits. Several leading biomedical journals now require each coauthor to sign a statement that he or she played a significant role and to identify what that role was. The International Committee of Medical Journal Editors has issued "uniform requirements."

There is a well-developed convention in life sciences and biomedical publishing about the order of authors: The primary researcher is expected to be the first author, especially if that individual really did lead all aspects of the project from design to conduct to analysis, even with guidance and assistance at each stage. For many faculty, it is a priority to put first a graduate student or postdoctoral fellow, or even an exceptional undergraduate

student, when that status has been earned. If two individuals share this lead responsibility, the lab may publish a pair of papers with a different first author on one of the two papers, or may use asterisks to identify each as "equally contributing to the work." A statistician is required for many kinds of studies to assure the credibility and quality of the quantitative inferences. The statistician, if not the primary researcher, is usually given the second position. For certain kinds of studies, especially clinical trials results, journals require that a qualified statistician be willing to put her or his name on the paper. The senior investigator or lab director generally goes last, as a means of indicating who had originally obtained the research grant. In multi-author collaborative studies, other coauthors are fit into the order, sometimes alphabetically, sometimes in subgroups by institution or role. The practice in the social sciences of presenting authors alphabetically is unknown in biomedical fields.

As might be expected, there can be disagreements within the group about who should receive the credit of being first and, when more than one senior leader is involved, who should be last. These authorship positions matter a lot, subsequently, in competing for faculty positions, in being considered for promotion, in being evaluated for grant funding, and in individual awards for research achievements. Decisions about academic advancement put a premium on "independent" research and independent grant funding. This premium is excessive, especially when many kinds of life sciences research now clearly require and benefit from a multidisciplinary team approach. Sometimes someone yields on author position just to avoid conflict, only to suffer later in individual evaluations. Sometimes the group asks a shrewd or well-connected member of the team to take on the responsibility of writing the manuscript in order to maximize the quality of the paper, the match to the target journal, and the likelihood of acceptance for publication. This tactic demonstrates the many pressures on authors—from colleagues, department chairs, technology transfer offices, and press offices; indeed, it introduces the chapter on authorship in the Office of Research Integrity document on responsible conduct of research (Steneck, *Office*).

In large collaborations involving dozens of participating investigators, papers will frequently have only the names of a few leaders of the whole collaborative group, or use a group name, and then footnote the remaining authors or participating investigators. Many journals in recent years have limited the number of coauthors listed in the bibliography to conserve space; some permit one named author with the rest covered by *et al*. Such

policies make the authorship opaque until the actual article is obtained. Some journals omit titles in the bibliography in order to leave more room for authors, yet titles are helpful to the reader perusing the literature cited. The point here is that journals have tremendous discretion. For these and other reasons, the leader of a large research team should encourage side projects with ancillary analyses so that individual members or small groups of researchers can have separate publications.

Choice of Journal

A distinct hierarchy exists among journals in regard to reputation and, consequently, the presumed quality of their articles. The "citation index," based on how many subsequent articles cite the article (with adjustments for self-citation, field, and specific journals), quantifies this ranking. Journals and their publishing companies advertise their citation index ranking as a way to attract the strongest manuscripts, as well as subscribers; they use it as the basis for advertising rates in those journals that accept (and seek) paid advertising. Some journals appeal to an audience across a broad range of scientific fields, specifically *Science, Nature,* and *Proceedings of the National Academy of Sciences;* among biomedical/clinical journals, the *New England Journal of Medicine,* the *Journal of the American Medical Association, Lancet,* and the *Journal of Clinical Investigation* have the most breadth and prestige. Every field, from cell biology to surgery, has its own pecking order for more specialized journals. The choices are enormous: PubMed indexes five thousand journals! The size of the biomedical research workforce and the numbers of journals continues to increase, making it especially difficult for beginners to be heard in the marketplace of ideas.

Like first-listed author status, the quality of the journals in which individuals publish carries substantial weight in appointment, promotion, grant-funding, and research awards. Thus, scientists seek to make their manuscripts appear attractive and important for the most competitive journals, and to respond precisely and aggressively to constructive criticism from peer reviewers and editors. Properly carried out, these activities insure the publication of the highest quality work in the most prestigious journals.

The Manuscript Review Process

In the biomedical and behavioral sciences, great emphasis is placed on peer review of submitted manuscripts. The editor and editorial staff must iden-

tify appropriate reviewers for each manuscript; often several reviewers must be asked in order to find two or three willing to undertake the review in the timeframe desired by the authors and editor. Of course, busy scientists have many other duties and deadlines, and a manuscript may languish awaiting review. The peer reviewer may find that cited or uncited articles need to be read in order to make a knowledgeable and fair assessment, which can lead to delay.

Critical ethical issues arise in peer review (Steneck, *Office;* Schachman). Some journals invite the authors to submit names for one or two potential reviewers; others examine the reference citations for appropriate names. Of course, these methods may introduce bias or favoritism. Some journals protect the reviewers' anonymity to encourage candid review, while others encourage voluntary identification, perhaps believing that reviews may be more conscientious and civil. Some journals remove the names of the authors when providing the article to the reviewer, yet most reviewers can figure out the likely research group from the methods and citations. Editors recognize the ethical problems in obtaining a fair reading of new work, but no one has resolved them.

Some authors are afraid that reviewers will be highly critical of the paper, or demand extensive, time-consuming revisions. Others worry that a reviewer will misappropriate, consciously or subconsciously, new concepts or findings to advance the reviewer's own research. This potential problem has its counterpart in peer review of grant proposals for new research or as an extension of current research. Delays in publication are both a career problem and an ethical problem in an environment that places priority on being the first to publish important findings.

After receiving peer review reports, editors exercise discretion about which papers to accept, since the top journals have room for only a minority of all submitted papers rated as highly credible. The editors may be looking for something unusual or newsworthy, or may have prejudices for or against certain topics or methods of analysis. Editors compete to attract exciting papers, promising expedited review or other advantages. Conversely, reviewers and editors may be unwilling to accept papers with unconventional methods or surprising findings—which may turn out to be breakthroughs.

Not all fields rely on peer review. Gordon Kane, in this anthology, notes the sharp difference between publishing in theoretical physics and the preoccupation of the biological sciences with the peer review of journal articles. He notes that certain fields of physics reject the notion of empowering

just two or three colleagues to act as quality control on papers; instead the practice of online publication encourages open publication, with the whole world immediately able to assess and criticize the report and the authors.

Conflicts of Interest

Conflicts of financial interest may arise, not just for the authors, but also among the reviewers. Medical journals now routinely ask reviewers to disclose potential conflicts of interest, but the process is for the most part voluntary. Conflicts may be particularly important with articles that show benefit or risk from medical therapies or products, affecting the pocketbook of particular companies or their competitors (Schachman). There is a mini-literature of publications demonstrating the high probability that authors supported by a pharmaceutical company will report results favorable to the product. Nearly a decade ago Deyo and colleagues published a report in the *New England Journal of Medicine* entitled "The Messenger under Attack—Intimidation of Researchers by Special Interest Groups." These groups—pharmaceutical companies, patient advocacy organizations, providers and advocates of surgical or other procedures, and plaintiff lawyers—sought to block the publication of findings that could undercut their business interests, or attempted to discredit the publication and the researchers when the paper appeared in print or was presented at a scientific meeting and highlighted in press releases from the conference. Why are editors not more suspicious? Why are authors so disingenuous?

Under federal guidelines, there exist three categories of scientific misconduct: fabrication, falsification, and plagiarism. There are quite a few celebrated cases of fabrication or falsification of data. A red flag should go up when individuals, especially in leading labs, have publication rates far above the reasonable upper end of the peer group (Claxton). The federal government established what is now called the Office of Research Integrity in 1989; they investigate some two hundred cases per year. For the year 2001 for example, ORI investigated twenty-four cases of fabrication, twenty of falsification, and four of plagiarism (Steneck, *Office*). All institutions utilizing NIH research funding are required to conduct training in "responsible conduct of research" for all trainees (Steneck, "Fostering Integrity"). Audits have shown that some individuals list articles as published or in press that do not exist, a particular form of falsification that is hardly unique to scientists.

The ORI website includes numerous educational initiatives, including "a guide to ethical writing" (Roig). The criteria for plagiarism are quite elastic, ranging from finding a certain minimal number of identical words in a sentence or phrase to substantial lifting of text or data from other published works. For example, the term "plagiarism" covers the lifting of extensive text, figures, or tables from another author without attribution; duplicate publication by the same author; and a very restrictive definition of any six consecutive identical words. In this era of electronic searches for phrases, it is simple to run a search on suspicious statements or phrases. The subset of self-plagiarism is generally frowned upon; a more serious problem is dividing one publishable set of work into numerous overlapping or redundant papers submitted to multiple journals. Whatever the definition, an inoffensive, actually desirable, use of redundant language arises from identical descriptions of experimental and analytical methods, reflecting standardized procedures. A May 19, 2005, editorial in *Nature* on plagiarism led to a flurry of letters and further articles. In general, federal requirements and university procedures are focused on fabrication and falsification of data, with much less attention to plagiarism. Universities and faculty groups chart an uneasy course between fearing adverse publicity and public and congressional stereotyping and threats of litigation from accused individuals.

The broad category of plagiarism raises numerous ethical questions about careerism versus appropriate shared standards. How much overlap in successive publications is permissible by an author? How can the sequencing of a series of publications by one research group be made more coherent? Authors have little control of the actual timing of their publications. Increasingly, authors utilize electronic listservs and appropriate websites to maintain collaborative and mutually informative relationships. Journals are putting articles on line when accepted, sometimes months before the printed journal appears. Since monographs and book chapters generally summarize and synthesize previously published work, what must authors do to avoid a potential charge of plagiarism? One approach to avoid self-plagiarism is to hold new material for peer-reviewed submissions. The reviews then could focus on the integration of published material, hopefully with fresh interpretations.

Journals could screen manuscripts for plagiarism, once criteria are agreed upon. As the editors of *Nature* have noted, arbitrary word limits for detection of plagiarism or self-plagiarism are unwise; they suggest a useful, user-friendly software tool that identified acceptable duplication (authors'

websites and properly referenced quotations) and a new category of missing information—articles hidden behind subscription barriers to online search of whole text. But such tools can only go so far.

There are significant pressures on authors. Many journals have strict page limits or word limits. Editors may force authors to shorten manuscripts and publish only a portion of the data, leading to multiple smaller papers. Authors have long struggled with the obligation to present methods in sufficient detail so that another lab could repeat the experiment and expect to obtain the same results, so as to have a basis for extending the work. Withholding critical details may cause others to fail and will lead to controversy about the findings. Fortunately, the Internet now makes it feasible to publish methods and supplementary results in depth without utilizing print pages in the journal.

Editors use precious pages for commentaries by others to promote the importance of selected articles. As noted above, editors are competing for "hot" articles, offering accelerated review, releasing "embargoed" versions of upcoming journal issues to the press, a practice initiated by the *New England Journal of Medicine* decades ago. The general media have come to rely on such access, raising the stakes for the authors competing for attention for themselves and their institutions.

The "rules of the road" for responsible conduct of research include professional codes, government regulations, institutional policies, and personal commitments to the basic principles of honesty, accuracy, efficiency, and objectivity. Society trusts that the results of research reflect an honest attempt by scientists to describe the world accurately and without bias (National Academy of Sciences). The relevant literature encompasses thousands of articles and a few hundred confirmed cases of misconduct. Fabrication, falsification, and plagiarism as elements of "scientific misconduct" are more objective than earlier terminology of *deception* or *fraud,* which required demonstration of deliberate intent. The terms *research integrity* and *questionable research practices* are even broader, embracing sloppy research, inaccurate methods, excessive claims of accuracy (numerous significant figures), poor mentoring, bias, and conflict of interest (Institute of Medicine; Committee on Science, Engineering, and Public Policy; Schachman; Steneck, "Role" and "Fostering Integrity"). Journals that have given these matters particular emphasis are the *Journal of the American Medical Association, Academic Medicine,* and *Science and Engineering Ethics* (Steneck, "Institutional and Individual Responsibilities").

Scientific Publishing as Business

Library budgets are overwhelmed with high subscription charges and a proliferation of journals. During a recent ten-year period, subscription charges for journals from commercial publishing houses rose 224 percent, uncorrected for inflation (Frank). For-profit conglomerate corporations are consolidating the academic publishing industry. Conversely, many scientific societies and nonprofit organizations depend upon the revenues and prestige of their journals. Of course, peer review and scientific publishing are costly; if subscriptions and reprint charges are to be dropped, or made irrelevant through downloading from the Internet, it will be necessary to have publication fees placed on the authors and their funding agencies. Many journals already impose such charges on top of their subscription income. NIH, Howard Hughes, and Wellcome Trust have announced that they will pay such charges for their grantees. The current (and foreseeable) budget situation at NIH, however, makes the accelerated adoption of these policies and the inclusion of these costs more complicated.

Partly as a response, the open-access movement has emerged. Led by several prominent biomedical scientists, a new publishing venture called Public Library of Science (PLoS) has secured generous financial support from the Gordon and Betty Moore Foundation to publish electronic journals without fees for subscription or access. One of its arguments is that taxpayers have already paid for the conduct of the research, so ready access to the results without charge and without delay should be a public benefit.

Another impetus for open access is the frustration felt by individuals without site licenses at their universities, companies, or public libraries. In many cases, such individuals can access the abstracts for articles online via PubMed, but they cannot access the full content of the paper. Patients, patient advocates, and especially lawyers find this barrier irritating. Scientists seeking to confirm findings in a long list of potential reference citations likewise are irritated by a barrier that offers access, however briefly, to the text only with payment of between $19 and $29 per article. Journals, while trying to protect their subscription base, have begun to make all text available online after a period of twelve months or less. NIH has issued guidance that calls on journals to do so within twelve months of publication and urges authors to make articles available informally through websites. There is pressure on the NIH, including from interested members of Congress, to accelerate this process. NIH guidance, moreover, has caused

some confusion about whether the submitted manuscript, the accepted manuscript, or the final edited published manuscript will be made available, at least initially.

PLoS publishes *PLoS Biology, PLoS Medicine, PLoS Computational Biology, PLoS Genetics,* and *PLoS Pathogens*. These are rapidly becoming highly cited journals. BioMedCentral has created more than one hundred open-access journals in the past two years, with more than four thousand original articles. Many established journals now use websites to make available extensive datasets, tables, figures, and detailed methods for which the journal does not provide space in the print version. BioMedCentral has such online features as the provenance of the paper—the original submission, peer reviewers' comments, authors' responses to the reviews, the revised manuscript and reviews, and citations after online publication. It is likely that these online open-access journals will continue to grow. Established journals, like *Science,* will very likely continue to sell print and electronic subscriptions, since readers highly value the "News and Comment" and other features of the journal, besides the original research articles. (Author disclosure: I am currently chairman of the board of the American Association for the Advancement of Science [AAAS] that publishes *Science*.) But, clearly, there is ferment in the scientific publishing world. The view that "knowledge is a public resource" is gaining traction. The AAAS position is, "We welcome experiments and assessments, and expect change." While it is unlikely that biomedical research will move completely to online publication, following the model of theoretical physics, clearly online access will become increasingly important, for it includes not only the fuller versions of articles, but also important unfiltered access to work.

Scientific Research and Bio-Security

In this era of renewed concern about bioterrorism, homeland security experts, the media, and the general public fear that new biotechnology methods and open publication of life sciences research on infectious agents may serve the interests of terrorists. Articles describing how to assemble poliovirus or reconstitute the 1918 influenza virus have caused consternation. Introducing highly infectious organisms into the food supply through livestock or crops could be hugely disruptive to our society. The line between defensive and offensive biological research is "perilously thin," resting on the intent and perception of different parties (Allison). Many reports have been published on this matter, and national and inter-

national agencies are trying to balance the value of new knowledge and methods—including the value for counterterrorism—against the risk of deliberate misuse. This dilemma derives from what are known as "dual-use" technologies, long a matter of restrictive regulation in the computer sciences and other fields directly utilized in military systems. Now, in addition to Cold War antagonists and "rogue nations," we must anticipate the intentions and actions of terrorist groups.

For those interested in these matters, a series of major reports from the National Research Council can be recommended. *Biotechnology Research in an Age of Terrorism* (the Fink Report) (Committee on Research Standards) urged expansion of existing regulations alongside reliance on self-governance by scientists and editors. Governments were advised to trust scientists and journals to screen their papers for security risks. Seven types of risky studies were identified as requiring advance approval by Institutional Biosafety Committees—such studies as making an infectious agent more lethal or rendering vaccines powerless. In response, the Department of Health and Human Services became the lead agency for implementation of the National Science Advisory Board for Biosecurity, with twenty-four members outside the government and fifteen agency ex-officio members. This committee is quite active. Another committee addressed "Pathogens, Open Access, and Genome Databases" (Committee on Genomics, *Seeking Security*). NRC published *Globalization, Biosecurity, and the Future of the Life Sciences* (Committee on Advances in Technology), touting cutting-edge scientific developments like nanobiotechnology and synthetic biology, and calling for vigilance internationally and in the intelligence agencies, while relying on self-governance in the research community. Instances of misconduct or misuse could make this whole scheme open to charges of inadequate safeguards.

Scientific publishing is a complex process with many public and professional benefits and responsibilities for all parties. Explicit attention to the pressures on researchers and journals, high standards for research integrity, and respect for the public's interest will benefit all parties.

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