Publishing in Academia: Woes of Authorship, Figures, and Peer Review

Publishing in academia today is more challenging than what our predecessors experienced 20 years ago. Today, publishing an academic manuscript requires command of what it means to be an author, the concerns over digital information related to figures, and the peer review process. Issues concerning authorship can be readily addressed and corrected by adherence to a set of guidelines such as ICMJE. The advent of powerful software programs has allowed rendering of publication-quality images, but these programs are easily susceptible to presenting data in a more favorable light, whereas they should not affect the integrity and data represented. The peer review process provides germane critiques to screen out substandard manuscripts; however, it can be imperfect, which requires further review and study. Successfully publishing in academia requires much specialized knowledge, as well as a firm grasp of authorship, figures, and peer review.

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INTRODUCTION

For many academics, particularly those at research-focused institutions, the maxim "publish or perish" serves as a poignant reminder that authoring manuscripts is key to one's survival and success. A prodigious bibliography can lead to employment at a well-regarded university, advancement within a department, or stability by acquiring tenure. The hurdles we must overcome today are more challenging than those our predecessors faced merely 20 years ago. Specifically, academic authors in the life or health sciences confront dilemmas over authorship, the peer review process, and the integrity of the digital information upon which we have become dependent. If we are not cognizant of these key points, our ability to be successfully prolific authors in the new millennium will diminish.

A competitive pursuit, cerebral in nature, publishing may be rewarded by the receipt of funding through government grants or private sources, recognition among peers, or public fame. Additionally, to be a successfully competent author in academia requires one to be ethical and refrain from publishing spurious data. We need not look further than recent headlines to see the damage from the publication of work by an unprincipled individual. One such example is the retraction of Dr Andrew Wakefield's study claiming a link between the measles-mumps-rubella vaccine and the development of autism. The results of this study were published in *Lancet* (1). Although overwhelming evidence demonstrated the vaccine to be safe, many parents refused to have their children inoculated (2,3). Britain's child vaccination rate decreased below 80%, resulting in a tremendous upswing in the number of cases of childhood measles (from 56 cases in 1998 to 1,370 cases in 2006), including the death of a child (3). Our additional responsibilities include knowing what it means to be an author, understanding legitimate practices for using computer software to formalize figures for publication, and appreciating the peer review process.

With our obligations as reputable authors established, we can journey through the new predicaments of publishing in academia. This article navigates the boscage of authorship, digital integrity of figures, and peer review so academics can sidestep potential indiscretions when they arise.

DILEMMA

AUTHORSHIP

Beginning in the 1600s and continuing until the early 20th century, almost all academic publications followed a simple model: one article, one author (4,5). As research became more interdisciplinary (ie, "big science") from the 1960s onward (6–8), shared authorship explod-

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TABLE 1

Criteria for Authorship as Defined by Various Sources

Source	Conditions
PNAS	"Authorship should be limited to those who have contributed substantially to the work."
ICMJE	Authorship is based on • Substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of data. • Drafting the article or revising it critically for important intellectual content. • Final approval of the version to be published.
Harvard University	• Made a substantial, direct, intellectual contribution to the work. • Everyone who has made substantial intellectual contributions to the work should be an author. • When done by teams whose members are highly specialized, individual contributions and responsibilities may be limited. • Participate in writing the manuscript by reviewing drafts and approving final versions. • One author should take primary responsibility for the work as a whole. • The primary author should ensure that all authors meet the basic standards for authorship.
Brain	"Each author should have participated sufficiently in the work to take public responsibility for the content. Authorship credit should be based on substantial contribution to conception and design, execution, or analysis and interpretation of data. All authors should be involved in drafting the article or revising it critically for important intellectual content, and must have read and approved the final version of the manuscript."

ICMJE, International Committee of Medical Journal Editors; PNAS, *Proceedings of the National Academy of Sciences*

ed from 5 to nearly 1,000 (9), not to mention an intense and fierce competition for the coveted first author position. But what defines an author? We are reminded that before modern times, an author was an individual regarded as both the originator and authority of the data, rather than the banal description "someone who writes some type of text" (4). However, in today's context, what does it mean to be an author of a contemporary academic manuscript? Surprisingly, there is no straightforward or definitive answer. Rather, one finds multiple definitions supplied by faculty members, academic institutions, journals, and committees. A select few guidelines or methods of determining authorship are provided in Table 1. As outlined by these sources, some rules are quite explicit while others remain very broad, even vague. Phrases such as "contributed substantially" appear fairly reasonable, yet their subjective nature begs for interpretation in more ways than one. To circumvent ambiguity as much as possible, an entity such as the International Committee of Medical Journal Editors (ICMJE) has defined the realm where substantial contribution is applicable. Additionally, it has set forth several conditions that must be met to qualify for authorship. An informal and limited interview of doctoral students and young investigators in health sciences (including medical, environmental, and pharmaceutical fields) was conducted to determine how much they knew about the subject of authorship. To start, they were asked what authorship meant to them in their environment, to which more than half of the students replied with statements that equated authorship with working hard, defined as performing experiments and other laboratory tasks. Next, they were asked whether they were aware of rules that may determine general authorship. Most acknowledged the existence of some rules, yet no particular guideline was specified or mentioned. Moreover, none of the interview participants knew where or how such guidelines could be located. Is it any wonder that the number of articles dedicated to the subject of authorship has ballooned in recent years (Figure 1)?

An author has more tasks than merely translating scientific data into common language: study design, protocol implementation, gathering results, and analysis of data are chief among these duties. With deft skill, we must distill the initial components of the scientific method (10,11) to generate a solid hypothesis, such as "Do increased amounts of tumor necrosis factor alpha contribute to apoptosis of inhibitory neurons within the central nucleus of the amygdala in adult male rats during exposure to negative emotional stimuli?" With this focused question in mind, the steps outlined in a well-described and thorough protocol (eg, animals, conditions, equipment, techniques) are executed with minimal deviations. The straightforward process of acquiring the raw data leads almost seamlessly to its analysis, where one can begin to make inferences regarding the question of interest and evaluate the underlying hypothesis. An author is expected to contribute to the aforementioned phases as they are an integral part of data generation.

Given the information discussed thus far, we can glean who qualifies as an author in the life sciences. An author can be an individual (or group of individuals) who collects and transforms information from a study into a cogent written explanation. The written explanation should provide, at a minimum, the who, what, where, when, and how of the experimental process and results. Please note that additional tasks such as study design and synthesis of conclusions about the study may be used to resolve the contentious subject of authorship order.

While we can delineate what constitutes an author, we certainly can also illustrate what does not. In 2005, Claxton (4) succinctly outlined five instances where authorship is not warranted. They are described as coercion, gift (or honorary), support, ghost, and duplicate (Table 2). Coercion authorship has been described as the practice of granting authorship to individuals because they assert their position or their actions demand authorship (4). A gift authorship is marked by the primary author identifying a colleague who is admired but gave little to no contribution to the work (4,12). In

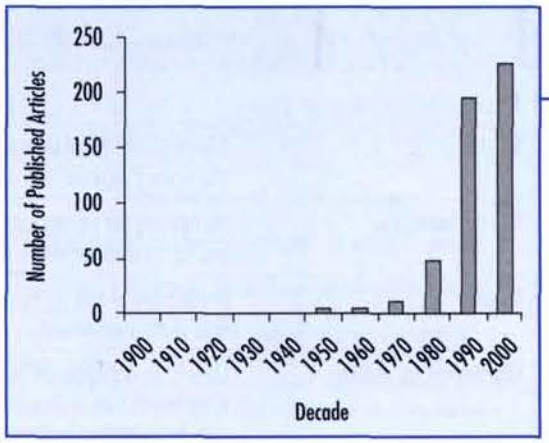

FIGURE 1

Bar graph displaying frequency of articles dedicated to the subject of authorship by decade from PubMed (http://www.ncbi.nlm.nih.gov/pubmed/, accessed June 20, 2010). The keyword "authorship" retrieved 3,882 titles. Of these, 492 specifically covered issues of criteria, ethics, guidelines, meaning, qualification, and responsibility.

fact, editors have employed draconian rules in the hopes of warding off gift authorships as well (12). A cousin of this practice, support authorship, is where two (or more) authors agree to place each other's name on articles knowing they made no direct contribution to the other's articles (4). Ghost or ghostwriting is defined as writing for and in the name of another (13). Due to the prevalence of ghostwriting in medical journals, US Senator Charles Grassley (R-Iowa) requested that the definition of authorship be solidified. Additionally, he requested assurances from journal editors that they have clear policies in place to mitigate this issue (14). Finally, duplicate authorship is the practice of publishing the same manuscript multiple times, whether in different journals, in newspapers, or on the Internet (4,15). The same informal interview population discussed earlier also revealed a number of instances of unwarranted authorship. When asked if they were aware of any instances of authorship that they considered improper or unwarranted, nearly all answered yes; however, when asked whether they knew of specific types of improper authorship, most answered no. Next, the categories of improper authorship as outlined by Claxton (4) were described, and they were asked which categories, if any, they had experienced either personally or through a colleague. Gift authorship was the most popular reply. When responses from the students and young investigators were evaluated separately, however, a difference in experience and observation was noted. For students,

TABLE 2

Inappropriate Authorship as Outlined by Claxton (4)

Type	Definition
Coercion	Where an individual asserts that his or her position, action, or both demand authorship, for example, when a superior with no direct involvement presumes he should be an author
Gift (or honorary)	Introducing the name of an individual who does not conform to the definition of author, for example, for a colleague that is admired or out of respect for colleague
Support	The practice of two (or more) authors placing each other's names on their articles where they had little or no involvement
Ghostwriter (or author)	Class 1: an organization has an individual with major influence in a particular subject who refuses to be listed as an author so the viewpoints can appear to come from independent research—typically from another organization Class 2: an author who is independently contracted to write (or rewrite) all or portions of an article, but is never acknowledged Class 3: a supervised person who is directed to write a significant portion of an article and not be acknowledged
Duplicate	Where an author or group of authors publish the identical work in more than one journal or other medium (Internet, newspaper, etc)

most unwarranted authorship occurred as coercion or gift. For young investigators, gift authorship remained the predominant issue, followed by duplicate authorship. Finally, nearly all respondents astoundingly replied that they had observed instances of authorship denial, despite the validity of the credit.

DIGITAL INTEGRITY

The advent of computer software to perform experiments and analyze data seems ancient history: protein quantification of an unknown sample using a 96-well plate reader is evidence of that. However, the extent of the implementation has changed in the last decade, together with the development of more complex computerized systems and programs. The tremendous convenience these systems have brought comes at a price, in particular the reliability of figures.

Figures succinctly report results that would otherwise be lost in words. They can be graphic in nature, such as a pie chart or table, or image-based, for example, the photomicrograph from a confocal microscope. To present the outcomes in a more favorable light, a line graph may be applied instead of a bar graph, or the increments on the axes may be increased or decreased to alter the perception of the results. Indeed, tables are susceptible to misuse and manipulation. Occasionally, percentages replace actual numbers, obfuscating the truth of a small sample size, underpowered study, or incidence of a desired effect or event, to name a few examples. Graphical misrepresentation of data is far more apparent than the manipulation of digital information.

Over the years, development of powerful imaging programs has allowed the production of publication-quality images. These programs have made rapidly labeling, cropping, resizing, and enhancing the properties of an image possible, whereas formerly such quality could be obtained only through high-end, expensive equipment to which most authors do not have access. It should be understood that minor adjustments such as cleaning up the background of an image are deception, which can be illustrated with an example of an assay. A particular assay may be suboptimal for a molecule of interest due to its reagents, conditions, and so forth. By cleaning up the image obtained from the assay, a false positive is produced. The conclusion is that the assay worked well and results are reproducible. When polled from the same informal group previously mentioned, nearly half of the respondents acknowledged some form of

computer software chicanery. As a case in point, deleting a lane (ie, a sample) from a Western blot because it did not conform to the hypothesis, for one reason or another, is an unquestionable example of such a practice. Though the unscrupulous may try to get away with this, such as the infamous scandal of stem cell researcher Woo Suk Hwang (16,17), the development and employment of forensic imaging software by journals (18) will make the ability to pass off bogus images nil.

PEER REVIEW

Unfortunately, it is peer review that provides one of the biggest frustrations, particularly for authors starting in the field. Ideally, the peer review process provides germane, thorough critiques of one's work such that it will screen out studies that are poorly conceived, designed, or executed, as well as trivial, marginal, or uninterruptible studies (19). Even today's editorials in science journals reveal a persistent flaw, where "we have good evidence on its [peer review] deficiencies and poor evidence on its benefits" (20–22). A summary of what has been identified at the international conference on peer review of biomedical literature (20) is presented in Table 3. By and large, when submitting manuscripts for publication, the feedback received from the often anonymous reviewers is beneficial in yielding a more robust article, whether it be a request to expand on the results section, explain the weaknesses of the study design or conduct, or focus the conclusion and discussion sections. But at times, reviewers unwilling to perform their role withhold legitimate manuscripts from publication. Not surprisingly, nearly all polled again disclosed that their reviewers had provided comments that were not relevant to the manuscript, that clearly showed evidence of not reading the entire manuscript, or were otherwise neglectful. Even the request to know the entire story of the biology under consideration can be counterproductive, relegating a respectable manuscript to the slush pile (20). While many veteran reviewers may wonder who has time to assess the originality, importance, design, and interpretation of the study, with references (internal and external) (20,23), without these basic points covered are we not doing a disservice to our field, colleagues, and ourselves?

Summary of Issues Identified at the First International Conference on Peer Review of Biomedical Literature by DNA Repair Editor in Chief Errol Friedberg (20)

TABLE 3

The Quality of the Reviews:
is not improved by blinding reviewers to author's identity.
has no association with the reviewers signing their reviews.
has no obvious effect when passing reviewers' comments to coreviewers.
produces slightly better quality reviews when reviewers are under age 40 years.
is still subject to appreciable bias and parochialism.
is challenged by the lack of useful instruments to measure the quality of a manuscript.

DISCUSSION

The pressure of publishing in academia is ongoing. The challenges of authorship can be addressed and corrected, with adherence to a set of guidelines, preferably one that is widely acknowledged and accepted such as ICMJE.

Congruent with being a good author is ensuring study integrity. When reporting results of a study, both positive and negative outcomes must be disclosed. Data cannot be cherry-picked to support the hypothesis of the study. Additionally, computer software and programs should not affect the integrity and representation of data.

Finally, the peer review process, like many systems born of duty, has its limitations. Hence, we must fulfill our duties to our colleagues in an unselfish manner, providing the best unbiased critique possible when called up for review. For as scientists, we could miss a potentially beneficial paradigm-altering work if we become participants in the politics of peer review. After all, funding opportunities are intimately tied to publication record and to wantonly dismiss another's work ruins our credibility.

great undergrad exercise, d'ailleurs!

Publishing in an academic world has transformed over the past 20 years, where almost all manuscripts are submitted electronically, the nature of the work has become more interdisciplinary, and the demands upon the author have substantially increased. Since the opportunity for advancement depends upon one's publication record, it is little wonder why there has been a tremendous concern over issues of authorship, digital integrity, and the peer review process. Publishing in academia is a worthwhile pursuit that brings many rewards; however, to achieve this, one must be willing to surmount the challenges of the current environment. With a clear map in mind, the aforementioned issues can be easily recognized and readily avoided to help one be a competently prolific author.

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