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# Pressures to Publish: Catalysts for the Loss of Scientific Writing Integrity?

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## Pressures to Publish: Catalysts for the Loss of Scientific Writing Integrity?

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### Abstract

Publishing research is the final step in the scientific process and is used as the primary means for disseminating research findings to the scientific community. Publishing can embody many personal motivations (e.g., gratification, seeing a finished product in print, desire to further science) for authors as well as professional benefits (e.g., promotion, tenure, future funding opportunities). As the scientific workforce and competition for jobs and funding increase, publishing productivity has become a driving factor for many authors, which may lead to writing practices that violate integrity. In this essay, we discuss writing actions that may be considered a violation of integrity in the context of traditional manuscript sections (introduction and discussion, methods, and results). We define “integrity” as consistency of actions that reflect honesty and truthfulness. Writing the introduction and discussion can be compared to an artistic creation because the rendition of the data may vary depending on the intentions and experience of the author. Some authors may be tempted to relate their research to a hot topic (e.g., climate change, model selection) in an attempt to increase publication success

or maximize visibility in search engines, despite not having sufficient data to support their conclusions. Caution must be taken to not overextend the “story” beyond the bounds of the data. Modification of the methods and results sections contains the most extreme cases of scientific integrity violations (e.g., changing an alpha level, only presenting positive results, running numerous tests until desired outcome). Manipulation of methods or results is more difficult to detect by peer review. We believe that however destructive integrity violations may be, despite benefits to the author (e.g., accolades, publication, potential citations, promotion, etc.), the individual scientist should hold him- or herself accountable and to a high standard to avoid sacrificing integrity.

## **Presión para publicar: catalizadores de la pérdida de integridad en la publicación científica**

### **Resumen**

La publicación es la etapa final del proceso científico y se utiliza como el medio principal para diseminar los hallazgos de una investigación. Para los autores, publicar puede implicar distintas motivaciones tanto personales (p.e. satisfacción, ver un producto final impreso, deseo de hacer más ciencia) como profesionales (p.e. promoción interna, basificación, oportunidades de financiamiento). A medida que se incrementa la fuerza laboral científica y la competencia por trabajo y financiamiento, la productividad en cuanto a las publicaciones se ha convertido en un factor determinante para muchos autores, lo cual puede dar pie a prácticas de publicación que comprometen la integridad. En este ensayo se discuten aquellas prácticas de publicación que se considera que comprometen la integridad en el contexto de las secciones habituales que conforman un artículo (introducción y discusión, métodos y resultados). Se define la integridad como la consistencia en acciones que reflejan honestidad y veracidad. Escribir la introducción y discusión se compara con una creación artística en cuanto a que la interpretación de los datos puede variar dependiendo de las intenciones y experiencia del autor. Algunos autores pueden estar tentados a relacionar su investigación a un tópico de actualidad (p.e. cambio climático, selección de modelos) en un intento por incrementar el éxito de la publicación y maximizar la posibilidad de ser encontrados mediante motores de búsqueda, a pesar de que no cuentan con suficientes datos como para apoyar sus conclusiones. Se debe tener cuidado para no extender la historia más allá de los límites que establecen los datos. La modificación de las secciones de métodos y resultados implica los casos más extremos de violaciones a la integridad (p.e. cambiar el nivel de alfa,

presentar sólo resultados positivos, realizar numerosas pruebas hasta que salga el resultado esperado). La manipulación de los métodos o los resultados resulta particularmente difícil de detectar durante el proceso de revisión por pares. Creemos que no obstante lo destructivas que puedan ser las violaciones a la integridad y a pesar de los beneficios que obtengan los autores (p.e. premios, potencial de citación, promociones, etc.), el individuo científico debe mantener su sentido de responsabilidad y sus estándares en alto con el fin de evitar sacrificar su integridad.

Publishing research results is the final step in the scientific process and is used as the primary means for disseminating research findings to the scientific community and society at large. Publishing provides authors the opportunity to demonstrate the context of previous research and to show how their current research will advance our knowledge or understanding of a certain topic, theory, or phenomenon. Perhaps most important, publications allow readers to formulate new hypotheses about current issues or challenges facing science, generate discussion about research results from other studies, and aid in future project designs and development. Publishing moves science forward.

Publishing also embodies many personal motivations for the authors, such as gratification, pride, or satisfaction in viewing research in print and/or cited, as well as the fulfillment of a completed project (Bennett and Taylor 2003). Additionally, the writing process allows authors to call upon their creative side, and it allows authors to believe that publishing their results will further benefit science and society in their particular field or related field (Bennett and Taylor 2003). Similarly, publishing translates to professional benefits as well. Promotion and tenure are determined in part by publications (De Rond and Miller 2005; Strange 2008). Publications can also help with future funding opportunities because publications demonstrate scientific ability, research innovation, and productivity (De Rond and Miller 2005; De Vries et al. 2006; Strange 2008).

As the scientific workforce and competition for jobs and funding increases (Strange 2008), publishing productivity has become a driving factor for many authors (Fang and Casadevall 2012). Young professionals (e.g., graduate students and assistant professors) are impacted the most by these increased pressures to publish to ultimately build their reputation in the scientific community (DeRond and Miller

2005). As such, graduate students are repeatedly advised that to become successful, publishing is the area where most effort should be allocated (De Rond and Miller 2005; Jolley and Graeb 2007). In fact, Statzner and Resh (2010) suggested that graduate students in ecology should publish 15 scientific articles to obtain a professional position. Therefore, publishing is held in much higher regard than any other activity (e.g., teaching, professional service, coursework). For these reasons, publications could essentially represent the currency or capital (De Rond and Miller 2005) within our profession.

As the pressures to publish increase, authors may publish only positive or significant results (Angell 1986; Fanelli 2010), publish numerous papers (resulting in least publishable units or “salami slicing”; Broad 1981; Statzner and Resh 2010), and/ or relate their study or topic to some “grand ecological theory” that is more likely to be published (Hillborn 2006) over a less popular idea. In some instances, these publishing actions may be considered a form of scientific fraud and may be considered a violation of scientific integrity (e.g., Angell 1986; Martinson et al. 2005). In this essay, we further discuss writing actions that may be considered a violation of this integrity. These actions may present greater threats to scientific integrity than outright fraud (e.g., fabrication, falsification, plagiarism; Martinson et al. 2005; De Vries et al. 2006). In light of increasing publishing demands, students and young professionals may adopt publishing strategies that may not result in sound scientific manuscripts. For this essay, we define “integrity” as consistency of actions that reflect honesty and truthfulness. Our approach is to discuss these strategies in each of four traditional publication sections (i.e., introduction, methods, results, discussion). Additionally, we provide recommendations and strategies for authors on how to maximize publishing success while upholding the values and purposes of scientific writing. After all, scientists should strive to maintain integrity because this upholds all the positive benefits of the publishing process and allows for the dissemination of credible and useful information. We want to encourage students and professionals alike to engage in discussion on the publishing pressures, the potential temptations to violate scientific integrity, and strategies to overcome these pressures.

## Issues in the Introduction and Discussion Sections

Many actions associated with writing scientific manuscripts that are considered acceptable by some, but not by others, appear in the introduction and discussion sections of an article. Writing the introduction and discussion can be compared to an artistic creation. The rendition of an object (e.g., scenery, animal, scientific topic) may vary depending on the intentions and experience of the artist. Analogous to the artist example, the same data and/or results can be molded into numerous and sometimes conflicting stories. Essentially, the introduction and the discussion allow the most freedom in terms of creativity without jeopardizing the integrity of the study (i.e., compared to the methods and results sections).

The introduction section sets the stage for the manuscript and is where authors first “sell” their science to the reviewers and, pending manuscript acceptance, to the scientific world. The writer has free reign to focus the reader’s attention on the broad, sometimes farfetched application or grander idea of the study. The discussion section attempts to finalize the “sale,” interprets the meaning of the results, and relates the results to other studies or real-world phenomena. This is where the broad or global issue “buzzwords” are usually found (e.g., climate change, model selection), which have become increasingly popular over the past decade. As such, some authors may be tempted to relate their research to one of these hot topics in an attempt to increase publication success or maximize visibility in search engines, despite not having sufficient data to support these conclusions (Hillborn 2006). These actions may be the result of the increased pressures to publish and the competitive nature of our field.

Framing a study in a broad context so it relates to many different research arenas (e.g., relating mountain lion research to trout research) may foster or advance science and ultimately allow many of the positive benefits of the publishing process to be reached sooner or to a greater extent. However, caution must be taken to not over-extend the “story” beyond the bounds of the data. Generating a conclusion not supported by the information provided in the study could jeopardize many of the positive benefits of the publishing process. Ultimately, we believe that some of the complexity behind this issue stems from who defines the story and how it is interpreted by peer reviewers, editors, and the readers.

## Issues in the Methods and Results Sections

Modification of the methods and results sections after a study has been completed contains the most extreme cases of violations of scientific integrity (e.g., falsification, fabrication; Martinson et al. 2005). Scientific journals favor positive or significant results over negative or nonsignificant results (Fanelli 2010), which may lead authors to change an alpha level (e.g., 0.05 to 0.10) post hoc or run numerous statistical analyses until the desired “positive” outcome is met. Other examples include the failure to present data or previous research that contradicts the desired outcome or withholding details of the methods or results (Martinson et al. 2005; De Vries et al. 2006). These are only a couple examples that may fully maximize publishing success, but modifications to the methods and results section are deliberate and result in the loss of integrity (Martinson et al. 2005).

## Implications

In any scientific manuscript, the introduction and discussion sections represent the overall story being told by the researcher, and any loss of integrity (e.g., extending beyond the scope of the study) can usually be detected and addressed through the peer review process. However, manipulation of methods or results (e.g., altering the alpha level, running numerous statistics) are more difficult to detect by peer review (Broad 1981). Ownership should be placed on the author(s) and we believe that however destructive integrity violations may be, despite benefits to the author (e.g., accolades, publication, potential citations, promotion, etc.), the individual scientist (or scientists) should hold himself accountable and to a high standard to avoid sacrificing integrity. A compromise in integrity not only demoralizes the scientific process as a whole and brings shame upon one’s self and one’s institution, but it may also cause a loss of public trust, with one consequence being that funding agencies and other constituents might be weary of funding future projects, thus threatening the forward momentum of science (Fang et al. 2012).

Violations of scientific integrity and fraudulent behavior have been exposed in other professions, such as medicine and engineering (e.g., see Claxton [2005] for examples; Martinson et al. 2005; De Vries et



al. 2006; Steneck 2006), and some violations are considered to be related to the increased pressures to publish (Angell 1986; Martinson et al. 2005; Fang and Casadevall 2012). We also believe that these violations were an attempt to strategically meet the increased pressures to publish (Angell 1986; Martinson et al. 2005; De Vries et al. 2006; Davis et al. 2007; Fang and Casadevall 2012). In light of the perceived pressure to publish, various strategies can be used to maximize publishing success while maintaining scientific integrity (e.g., collaborate, work with extant datasets, conduct laboratory experiments; Table 1). For example, collaborating with other scientists could foster future relationships and not only result in manuscripts but also in future projects and a broadened research background. We have provided only a short list of ways to ethically maximize publishing; undoubtedly, many more exist.

**Table 1.** Recommendations and publishing strategies to maximize publishing success while maintaining scientific integrity and their associated benefits.

<i>Recommendations</i>	<i>Benefits</i>
Be creative and think “big picture” topics	If your manuscript applies to many different research topics, it may be cited more
Prepare a well-designed project	Will save time at the end of the project
Don't be afraid to move on when a paper gets rejected	Time can be spent on other (better) projects
Be patient and work hard	The publications will come
Establish a research niche early in your career	The researcher becomes more familiar with the literature, thus making it easier to gain funding, design experiments, and write up the manuscript for publication
<i>Publishing Strategies</i>	<i>Benefits</i>
Collaborate, collaborate, collaborate	Coauthors often have less work than the primary author. It will broaden your research background. It also allows researchers to develop professional relationships that may foster future projects or manuscripts
Work with extant data sets (students: ask your advisors if they have any of these lying around)	Fast turnaround rates because time is not spent collecting and processing data
Publish short communication briefs or notes	Often less time is spent on the manuscript and they have faster turnaround times than a full manuscript
Publish in peer-reviewed open access journals	Faster publication rate and impact factors may eventually rival traditional journals because they are more accessible
Conduct laboratory experiments and publish	Faster turnaround time than traditional field studies, and significant discoveries can be made in the laboratory
Publish class projects (for students and professors) or term papers	The work is already being done to complete the project for a grade and this is a way to boost manuscript quantities

## Conclusion

We postulate that true scientific greatness can only occur when nested in integrity and agree with Lee (1999), “that the most important trait in a scientist is integrity; this is above intelligence, creativity, or determination” (Brown and Guy 2007, p. 3). One of the primary missions of the American Fisheries Society is to advance fisheries and aquatic science and promote the development of fisheries professionals—these goals are impossible without integrity at the heart of the scientific process. We recommend holding science at the same level or ahead of personal or professional benefits, and we never recommend placing personal or professional gains as a priority, because this will no doubt result in a sacrifice of sound science.

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