

Scientific Authorship: Giving Credit Where Credit Is Due

With the ever increasing demand to publish and produce associated bibliometric data, such as number of citations, *h*-index, and the like, the number of authors and disputes about author order on a manuscript are both sharply on the rise. Appropriate and fair representation of those who have contributed to a manuscript is greatly desired. But it is also a complex task that might be expected to vary from one discipline to another. Indeed, it would seem that what it means to be an author needs more discussion. Often, many have contributed peripherally, but vitally, to the completion of the body of work described in the manuscript. Do they deserve authorship? It is easy to recognize that carried to an extreme, this type of involvement would produce a lengthy and unwieldy authorship list that might include scientific greats such as Newton, Einstein, Gauss, Euler, and others. That would be ridiculous, but where should we draw the line?

Authorship is not just about giving proper recognition to people who did the work. The integrity of the whole scientific enterprise is at stake because the public bases its admiration of science and its practitioners on the reliability and trustworthiness of the scientific publication process. Anything that contributes to the outside public having more confidence in the scientific process as revealed by its publications should be applauded. Scientific research can only thrive with the support of the public, so that this matter is not a trivial one or solely limited to within the confines of research laboratories.

The International Committee of Medical Journal Editors¹ does provide some useful guidance about what constitutes authorship. The gist of what they suggest is that an author must take responsibility for at least one component of the work, should be able to identify who is responsible for each other component, and should be confident in their co-authors' ability and integrity. This group goes on to recommend that authorship is warranted when four conditions are each met:

- (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; and
- (2) Drafting the work or revising it critically for important intellectual content; and

- (3) Final approval of the version to be published; and
- (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.⁷

Those who have contributed, but do not satisfy, the above four criteria ought to be cited in references, in footnotes, or in the acknowledgements of the manuscript. Best practice would be for the authors to obtain the permission of those living individuals before listing their names in the acknowledgement or issue a disclaimer that being identified in an acknowledgement does not mean endorsement of the results and conclusions of a study.

It is remarkable to me that many of the authors claim no responsibility for what went wrong in published papers that have had to be retracted. If the practice recommended by the International Committee of Medical Journal Editors were followed, this type of defense whereby in many cases everyone but one author is exonerated would be greatly reduced.

It would seem that the above guidelines are clear and succinct. But in practice, many grey areas still appear. The earlier in the research process that authorship can be discussed and established, the better the expected outcome. One of the quickest ways to produce a poisonous laboratory atmosphere is to have rampant authorship disputes.

One may ask how important is it to get the authorship question correctly resolved? If some deserving individual is omitted, it is obvious that damage has been done. The currency in the academic realm is reputation, which is certainly based, in large part, on the publication record of an individual. But does it hurt to include too many authors? Should authorship be awarded based on acquisition of funding, general supervision of a research group, general administrative support, or writing assistance? These activities alone do not meet the four criteria listed above and raise troubling ethical questions. Naming too many authors reduces the credit that should be given to key researchers involved. Moreover, naming gratuitous authors inappropriately places accountability on others who are

not qualified to explain or defend the findings of the paper. Authorship confers credit but also comes with deep responsibilities and accountability for the published work.

Another perplexing problem is author order. Some say it is a team effort so the order does not matter; one should simply list the authors in alphabetical order. Others say what really counts is the first author and, to a lesser extent, the corresponding author. This last approach seriously hinders collaborations. Some try to solve part of this dilemma with a footnote claiming that some of the authors contributed equally, whereas what the meaning of equal is often leads to more questions. What are we to conclude about the efforts of all those other authors? What did they do? Why are they there? Who should we expect to be particularly responsible for which aspect of the manuscript?

It is my suggestion that all journals consider adopting the practices of one notable journal, namely, the *Proceedings of the National Academy of Sciences of the United States of America*. It publishes a brief description of the role of each author. I believe this practice would have many advantages, in not only providing proper credit to those who deserve it, but also eliminating the silly practice of many who think that the first author and the corresponding author deserve the only recognition for the published manuscript. With the increase of multi-authored papers involving researchers belonging to different disciplines, this practice would go a long way in letting readers know who did what. It would also signifi-

cantly encourage interdisciplinary collaborations because it would help reduce the needless agony of squabbling about who will be the first author of a study. It would also inform the interested reader who should be contacted about what aspect of the study. Some may still insist that everyone contributed to the research process as a team and should not be recognized separately, but at least we would know that is the prevailing attitude of the group or group leader. I also believe that a policy of encouraging authors to identify their contributions would help increase the reliability of the manuscript and help others appreciate better who did what. For many tenure, promotion, and job hiring decisions, knowing a researcher's contributions to a scientific publication is truly vital information. Finally, there is another beneficial aspect of describing the roles played by each author. It puts a human face on the trouble and toil that goes into generating research results. I think that any effort to do so should be warmly welcomed for showing others how research is really done.

1. <http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html>

Richard N. Zare

Department of Chemistry,
Stanford University,
Stanford, California 94305-5080, USA
e-mail: zare@stanford.edu