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Editorial

EDITORIAL

Preprints in Toxicology

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Imagine attending a national meeting with the expectation of 50–100 people showing up to your presentation, and looking up to see over 500 people cramming into the room to learn about your work. What would your response be? If you are like most scientists you would be pleasantly surprised and encouraged by the support. You would present your work and triumphantly exit the auditorium convinced your lab was onto something. Buoyed by the enthusiasm, you would be motivated to get the work published. It is less likely that you would respond, "Oh, no. 500 people just saw my work. They are going to go back to their labs, start from the beginning, replicate my work, and then publish it before me!" Yes, it may inspire additional experiments from competitors' labs, but if you are presenting a complete story, more likely than not, you are far ahead and there is no cause for concern.

Science is an iterative process. We have an idea and dream up an experiment. We perform the experiment. Sometimes the experiment works and yields useful information. We discuss the findings with our lab mates, repeat the experiment, analyze the data, have further discussion, and generate a figure. We do this a few times and a story begins to emerge. We then submit an abstract to a national meeting. That information it often made available to thousands of people through meeting books or websites. We present a poster or platform presentation, which exposes the work to dozens, if not hundreds, more. Colleagues and strangers make comments on the work. We return to the laboratory to perform additional experiments. Our graduate students present the work at our home institutions. For the most part, our work has not been kept secret. We actively seek input from colleagues so that we can improve our research.

The preprint represents one additional step in this long-standing tradition of revision, refinement, and improvement of scientific research. It is not an assault on the enterprise, but rather an important opportunity to advance science. Preprints are not new. Scientists have been sharing early versions of manuscripts for centuries. Paul Ginsparg at the Los Alamos National Laboratory developed the first preprint archive for the field of physics in 1991. This service called arXiv (pronounced "archive") was originally dedicated to papers in high-energy theoretical physics (http://www.arxiv.org). Today, arXiv provides free access to over one million electronic preprints in physics, computer science, mathematics, quantitative biology, quantitative finance and statistics. Other fields have followed suit. One of the more recent entries into the field is bioRxiv (pronounced "bio-archive"). bioRxiv is a free online archive for unpublished preprints in the life sciences, operated by Cold Spring Harbor Laboratory (http://biorxiv.org/). By posting preprints on bioRxiv, authors are able to make their findings immediately available to the scientific community and receive feedback on draft manuscripts before they are submitted to journals. The submissions receive a digital object identifier (DOI) that can be cited in grant applications, manuscripts, and on curriculum vitae. The DOI remains the same even if the authors update the manuscript. The previous versions of the manuscript are archived. The entry on bioRxiv is also automatically updated to include the journal citation once the work is published in a scholarly journal.

Toxicologists do not appear to be taking advantage of preprints. There has been some reluctance due to the fact that some journals refuse to publish manuscripts that have been previously published, but these policies have been more myth than reality. Oxford University Press, which publishes *Toxicological Sciences*, has a general policy that encourages publication of manuscripts that have been posted on preprint servers (although how this is handled is determined by each individual journal). *Toxicological Sciences*' official policy is to welcome submissions that have previously been deposited on a preprint server. This puts our journal in good company with other elite journals and publishers. Nearly all of the major publishers now accept preprints, including those that publish journals such as *Nature*, *Science*, *Cell*, *Neuron*, *Immunity*, *Proceedings of the National Academy of Sciences*, and *Analytical Chemistry*.

bioRxiv has had a section for pharmacology, but has not explicitly listed toxicology. A major subset of our field is

examining the adverse effects of pharmaceutical agents, but we dedicate a considerable level of effort to evaluate the adverse consequences of chemicals and other agents that exist in our environment. I was able to speak with the bioRxiv team and they have agreed to expand the pharmacology subsection to "Pharmacology and Toxicology". I view the listing of toxicology as a clear invitation to our field to embrace the preprint.

My own laboratory submitted its first preprint to bioRxiv in late September, 2016. Initially there was a bit of trepidation, we found the experience to be helpful in our manuscript preparation process. We did not receive direct comments, but we did receive email feedback from colleagues who read the work. Anticipating posting the manuscript to the preprint server drove us to sharpen the manuscript and ultimately, we submitted a stronger manuscript to a traditional journal weeks later.

Toxicological Sciences' policy is clear. We accept manuscripts that have previously been posted on a preprint server, such as bioRxiv. We want our authors to seek feedback from the research community. We believe that this increases the rigor, reproducibility, and transparency of our work (Miller, 2014; Waller and Miller, 2016). We do not anticipate all authors will use these services, but we encourage and applaud authors who do.

I will close with a final note on the fear of being scooped. Having another research team publish ahead of you can certainly be disheartening, but I argue that much of that anxiety is unfounded. I am reminded of a line from the late Sir Peter Medawar. Medawar was awarded the Nobel Prize in Physiology and Medicine in 1960. He was a superb scientist, and arguably, an even better writer. I was first introduced to his work when I read "Memoir of a Thinking Radish" (an obscure reference to Shakespeare's character Falstaff; Medawar, 1986) while in graduate school. I recently re-read his "Advice to a Young Scientist" in which he stated:

> "One of the most commonly endearing traits of a young research worker is the illusion that everyone else is eager to hurry off and do his research before he can (Medawar, 1979)."

There may be some reasonable concerns regarding prepublication, but for the most part investigators that continually fear being scooped suffer from the enduring nature of the endearing trait. In fact, the deposition of one's work in a preprint repository helps stake a claim of priority by providing a timestamp and DOI. Preprints have a long and successful history in other branches of science. The speed and reach of the internet do give modern preprints more potential coverage, but this has not notably changed the nature of the preprint in those fields that have employed them for decades. Therefore, set aside your fears and consider reporting your toxicology results via this emerging outlet in the biomedical sciences. After that, submit your preprinted manuscript to *Toxicological Sciences* and continue the process of dissemination.

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