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On the cover: Schistosomes are parasitic flatworms that infect hundreds of millions of people in developing countries. Before infecting humans, the parasites develop inside a snail intermediate host, enabling them to produce thousands of infectious offspring from a single egg. This image shows a tissue section of a developing Schistosoma mansoni larva (center) living inside the muscular tentacle of its snail host (periphery). The colors indicate different depths within the tissue. The research was completed at University of Illinois at Urbana-Champaign and Howard Hughes Medical Institute, and was supported by the NIH National Institute of Allergy and Infectious Diseases. Photo credit: Bo Wang, Stanford University, and Phillip A. Newmark, Morgridge Institute for Research at the University of Wisconsin-Madison.

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Pondering Preprints and Progress

Tracey A DePellegrin

Preprints have long been established in some fields, and they are on the rise in many others. It's easy to see why. Scientists painstakingly conduct research for years, and the primary output of this work is an article published in a scholarly journal. Sometimes that process takes a long time, or at least longer than researchers—and their audiences—want to wait to communicate findings.

Researchers in the life sciences are increasingly turning to preprint servers like bioRxiv (https://www.biorxiv.org/), which allows authors to deposit unpublished life science manuscripts, and posts those manuscripts online as a "preprint". Preprints are often simultaneously submitted to journals and deposited on a preprint server. Anyone with an internet connection can read and comment on the paper through the preprint server before it is published.

Evolving quickly are the ways journal publishers handle manuscript submissions that have been posted as preprints. Just 5 years ago many journals prohibited the submission of manuscripts that had been posted as preprints. Today most journals welcome preprints. Indeed, some editors scour preprint servers to recruit submissions.

The adoption of preprints varies by field. As of April 2018, bioRxiv has preprinted over 23 500 manuscripts from 134 000 authors representing 8500 institutions from over 100 countries.

The arXiv preprint server (https://arxiv.org/), a mainstay in the physics, math, and computer science communities since 1991, hosts over 1.3 million preprints. Other preprint platforms have been established more recently, including *PeerJ Preprint* (https://peerj.com/preprints-search/), and field-specific preprint servers such as ChemRxiv (https://chemrxiv.org/), EarthArXiv (https://eartharxiv.org/), engrXiv (https://engrxiv.org/), and ESSOAr (https://www.essoar.org/).

Questions remain as preprints are becoming part of the scholarly publishing ecosystem. Can preprints be cited? Should editors use preprints and their posted comments as part of the manuscript peer review? How can journals ensure that only one version of record exists? Additional questions arise when one thinks of preprints in the field of medicine and health sciences, and how these sometimes life-and-death scientific topics might be used. MedRxiv (http://yoda.yale.edu/medrxiv), maintained by the Yale Open Data Access Project (affectionately named YODA), was created with those types of preprints in mind and has myriad policies around data access geared toward a niched audience.

Preprints are rife with opportunity. Comments about preprints arising on social media or a preprint server can be useful, in particular as a way for authors to garner initial feedback. Scientists can also establish precedence of ideas and connect their work to readers as soon as possible. Journal clubs discussing preprints are popping up, providing early career researchers with ways to engage with one another and with research. Some journals have "preprint editors" who trawl the servers in the hopes of recruiting manuscripts for their journals. Scholarly societies and other organizations can formalize preprint reviews, and when coupled with robust peer review in a journal, preprints can provide authors and readers with the best of all worlds. Scientists and readers can enjoy all the benefits of posting their preprint while it's undergoing review, thereby accelerating access to the work and still realizing the wins from a polished, revised paper that was peer reviewed, edited, published, and promoted (not to mention 100 other steps!).

Large, well-funded labs are flocking to preprints. Indeed, those labs are some of the most poised to submit to preprint servers. They have myriad colleagues able to read and revise (before submitting), and some have communications managers. However, smaller labs with fewer resources may benefit most from the structure of journal peer review, editing, and article amplification and promotion.

There are many benefits to preprints covered in already-published articles, so rather than delve too deeply here, I have included a list for further reading, below. Full disclosure: GSA Journals were the first to partner with bioRxiv to allow submissions at GENETICS and G3 to be seamlessly transferred to bioRxiv. See our editorial at http://asapbio.org/synergy and http://genestogenomes.org/gsa-journals-partner-biorxiv/. This arrangement with bioRxiv has worked for us since 2014.

As with most innovations, preprints come with some drawbacks, most of which I suspect will be smoothed out over the coming years. People worry about being scooped. Whether this fear is based on facts is unclear. Some scoff (one of my favorite bits of "anecdata" involves the loud vocalization that this fear is unsubstantiated because they haven't heard of this happening), but in today's hypercompetitive atmosphere, it's hard to blame scientists who have misgivings. Sure, the papers are free from those pesky editor and reviewer requests for additional

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experiments—but what if those additional experiments are actually necessary to support the paper's conclusions? If preprints are posted but never published in a journal, will they suffer from a lack of tagging, indexing, readership, promotion, and archiving (and 100+ other things journals do—see the post from Anderson, listed in the Further Reading, below)? With no vetting of content, it's not clear if a bogus preprint that contains misinformation on health, therapeutics, or biosecurity will mislead the public or the press. Some preprint servers guard against that kind of thing, but are all taking on that responsibility?

Related is the nature of preprint servers—low-cost to run, low activation/energy to submit—means that editorial offices and editors aren't combing through the submission and evaluating for the quality, the presence of data, an indication that all authors agreed to the submission (and how it will be used), and the presence of markers of scientific integrity.

Data sharing is one area preprints may lag behind. In an ideal world, authors are generous with data sharing and provide the raw data to support the paper. For myraid reasons not all scientists, however, are this open about data sharing (e.g., in genetics, work with populations associated with proprietary companies like animal breeders). What's a paper without data to back it up? Many journals require raw data before a manuscript will be considered for submission. Authors who are unable or unwilling to provide this data may not publish their papers in these journals.

My sense is that preprints aren't supplanting journals (not yet anyway). The two can co-exist peacefully and productively, and serve to improve the ecosystem and the scientist experience. We ought to understand the value of preprints and what proponents are saying, as well as the potential drawbacks.

As editors and publishers, we are entrusted by authors with years of their hard work. We must continue to carry out peer review and innovate process and policy such that we not only uphold, but also promote its integrity. We provide checks on ethics, and ensure data availability and quality. We make sure that papers are properly tagged, indexed, discoverable, readable, and citable. We highlight, promote, and discuss not just the science, but the stories and people behind the discoveries. We help improve a paper's impact not just for today, but for years to come.

I call on each of you, as members of the scholarly publishing community, to reaffirm your role as author advocates. Ideally, providing authors with robust, ethical, timely peer review of manuscripts and thoughtful decision letters from editors should improve their papers and their science. I think we must pay attention to what the market demands; if our communities want to use preprint servers, we owe it to them to understand how preprints might complement what we offer. We must work hard to serve our authors to address their changing needs and to provide our readers with articles worth their valuable time, or risk being left behind.

This issue of *Science Editor* features some must-reads, including an insightful piece about author surveys by Jessica Rucker and Jody Plank, PhD, from the American Chemical Society. They describe a Herculean effort to conduct a longitudinal study using rolling author surveys starting in 2015. To date, they have amassed more than 34 000 responses, and an almost-equal number of open-ended responses. This candid article proves interesting and useful, providing tidbits about their findings and lessons learned about understanding and engaging authors.

In "Reevaluating the Quest for Negative Results," Lenny Teytelman, PhD, asks readers to challenge some of our assumptions about publishing these papers. He asserts that there is no shortage of venues for publishing negative results; rather, there is a paucity of submissions. What follows is a discussion of the value of negative results and the nuances of understanding and publishing them.

Lorinc *et al*. in their Perspectives article "The Painful Publishing Process: A Request to Simplify Bureaucratic Requirements" make a plea for editors to allow manuscript submissions in myriad formats. It's a case you'll want to hear out.

We also introduce a column, "Fire of the Week," written by Emilie Gunn, who has also agreed to act as Editor for the regular feature. These pieces will describe the types of events (if not the actual ones) most of us can relate to—urgent, adrenaline-fueled emergencies that crop up, if not hourly or daily, than most certainly weekly. Emilie dissects what happened and why, plus the steps she took to mitigate the problem. These "fires" are so common that we are hoping you will share with *Science Editor* stories about your own and how you put them out.

Further Reading

- http://www.sciencemag.org/news/2017/09/are-preprints-future-biology-survival-guide-scientists
- http://mbio.asm.org/content/9/2/e00516-18.long
- http://blogs.plos.org/plos/2018/05/power-to-the-preprint/
- http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1005473
- http://asapbio.org/about-2
- https://scholarlykitchen.sspnet.org/2018/02/06/focusing-value-102-things-journal-publishers-2018-update/

Similarity-Detection Software Use by Scholarly Publishers

Jessica LaPointe

Introduction

Resources like CSE's *White Paper on Promoting Integrity in Scientific Journal Publications*[1] and the Committee on Publication Ethics (COPE) flowcharts[2] provide thorough descriptions of ethical misconduct and guidance for dealing with plagiarism and other ethical violations once they have been discovered. Scholarly publishers like the American Meteorological Society (AMS)[3] and the American Geophysical Union (AGU)[4] provide authors with their own policies regarding text reuse and plagiarism. Others, like the Proceedings of the National Academy of Science (PNAS),[5] direct authors to the COPE guidelines. However, questions remain regarding the most effective ways to use similarity-detection tools before violations occur.

As the use of text similarity-detection tools becomes more widespread across the industry, scholarly publishers are wrestling with a number of common questions: What approaches are other publishers taking with regard to issues of self-similarity and plagiarism? How are they using similarity-detection tools, if at all? What percentage of similarity is acceptable, and how is that percentage determined? What challenges do publishers face, and how are they being addressed? For the CSE Publication Certificate Program, I undertook a project to uncover trends in the scholarly publishing community's approach to similarity detection and identify best practices in the timing of using similarity-detection software (SDS) and workflow management (e.g., who does what when, and how to determine appropriate levels of similarity). Herein, I present my findings, including the survey results, along with some analysis and conclusions.

Results

Of the total of 44 respondents, the overwhelming majority (41) indicated they are currently using SDS. Similarity Check (by iThenticate) was identified as the most commonly used tool, but PlagScan, WCopyfind, Turnitin, Grammarly, and, generically, free online software were also mentioned. According to nearly 67% of respondents, "integration with existing software (e.g., submission/manuscript tracking system)" was the main reason for choosing a particular tool. In addition, 30% claimed "ease of use" and approximately 24% claimed price as the reason they chose one tool over another (for many questions, more than one option could be selected, so the percentages may not equal 100%). Several respondents provided additional comments, many of which indicated the decision was out of their hands or was made before they were hired at their present organization. Others mentioned the lack of choice because only one SDS was offered by their publisher or integrated with their manuscript tracking system. More than 65% have been using SDS for more than 2 years; one replied they have been offering it for over 5 years, but clients have been requesting it only within the last 2 years.

Roughly half the responses stated their organization changed its policies regarding text reuse/recycling and plagiarism as a result of using this SDS, and those changes were principally driven by staff; changes were driven by peer reviewers in only about 7% of the cases. The comments indicate the use of SDS has allowed staff to determine the extent of text recycling and develop more detailed guidelines in response.

While only about half of these organizations have changed their policies, almost 70% have changed their instructions for authors and editors. The comments indicate they provide information to authors and editors regarding their use of the software and clarify expectations for authors. It has also helped them to educate authors about the need to avoid recycling text without proper attribution. It seems one of the key benefits of using SDS is author education. Most respondents have guidelines on text reuse/recycling in their instructions for authors. Some evaluate instances on a case-by-case basis and may offer instructions to authors if necessary. Some direct authors to their Office of Research Integrity or provide authors with standard text from their publisher. Respondents mentioned the need for ongoing author and editor education to improve compliance with their guidelines.

Which papers get the SDS treatment? About 60% replied similarity-detection software is used on all papers. Nearly 17% replied that papers are chosen at the discretion of the editor, and just over 7% check a random selection of papers. Most of the comments revealed that SDS is applied to all the papers that have gone through peer review. In a few other cases, papers are checked only if the reviewer or editor suspects a case of plagiarism or text reuse/recycling. One reply indicated it would be done at the author's request, and another commented only review articles are checked. According to these responses, SDS is used primarily at initial submission (~54%; Figure 1), but the comments indicate papers tend to be checked after acceptance. One reply

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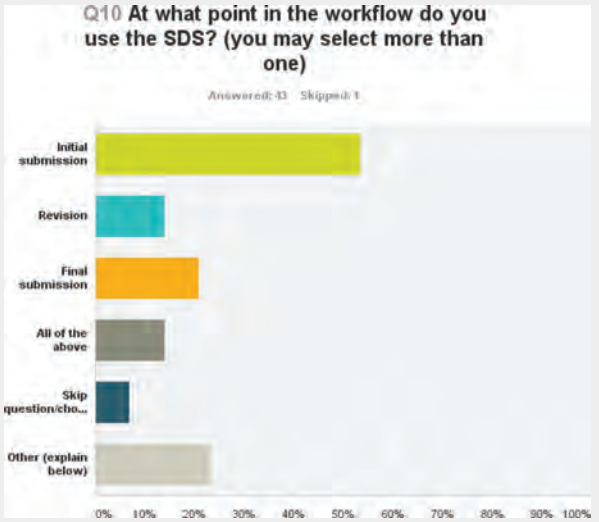

Figure 1. Graph of responses to Question 10: At what point in the workflow do you use the SDS?

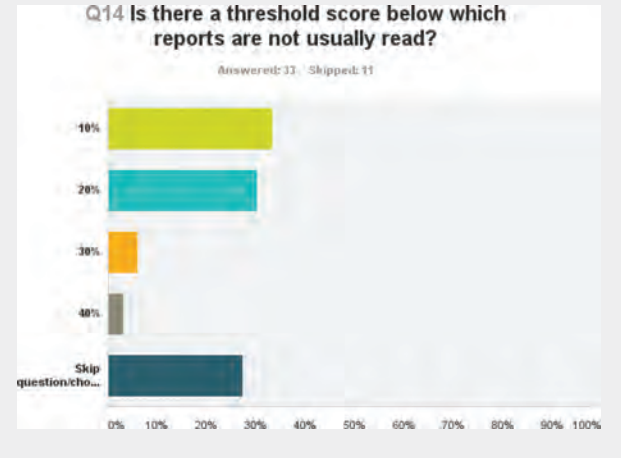

Figure 2. Graph of responses to Question 14: Is there a threshold score below which reports are not usually read?

explained that checking papers after acceptance, rather than upon initial submission, reduces the workload associated with processing the papers. Nearly 14% of respondents indicated SDS is used when an author submits a revision, and about 21% use it after the final submission.

Nearly 60% of respondents indicate they use SDS at the beginning of the workflow to weed out potential problem papers as early as possible; over 44% replied they do it to keep papers with serious problems out of peer review to save the peer reviewers time. Others identified cost and staff/volunteer time as reasons they use SDS at a particular point in the workflow. One detailed comment explained that checking all papers would be more trouble than it is worth, considering text reuse/recycling is not that much of a problem for that organization. Because the percentage match can be misleading, reports are read carefully, which takes time but results in a more accurate assessment of the paper.

The responsibility for reading the reports that are generated by the SDS falls both to "editorial board members (chief editors, editors, etc.)" and "staff (e.g., production staff, copy editors, technical editors)". As expected, the reports are analyzed by the same people who are responsible for making the final decision to accept or reject the paper, which in some cases is a paid staff member (like the managing editor) and in other cases is the editor-in-chief.

The percentage similarity match score may be a "red herring," but having a threshold for not needing to read the report would surely save peer reviewers and staff some precious time. Over 60% of the responses indicate a similarity score of 20% or less means the report will likely not be thoroughly read (Figure 2). Two respondents indicated they would likely not read the report with a score of 30% or less, and one respondent gave a threshold of 40%. Nearly a quarter of respondents chose to skip this question, but there were several detailed comments. Some provided an alternative score, such as 5%, 15%, or 25% (and in one case, 50%), at which they would read the SDS reports. Most of the comments indicated that the complete report would be read, regardless of the similarity score. As far as why a particular threshold was chosen, responses ranged from "it's important to read every report" to "the threshold seems to let through almost all good papers while catching the majority of plagiarized ones." Many comments pointed to the value of experience when reviewing the reports, since a low similarity score might disguise the fact that an entire sentence was taken verbatim from another uncited source, while a high score might be the result of many short phrases or terms that appear in other papers, which does not constitute plagiarism or a violation of the publisher's ethical guidelines.

There was no clear consensus regarding a similarity score at which the report would always be read (Figure 3). Many replied that all reports are read, regardless of score. This highlighted the fact that SDS users seem aware of the limitations of similarity scores: they can only indicate the percentage of text that matches an existing publication, but they give no indication of the nature of the text recycling and whether it constitutes a problem that needs to be addressed. Experience was cited as key in deciding how to use the SDS scores. Once editors gain familiarity with the tool and the similarity reports, they are better able to gauge what similarity score might indicate an actionable problem with the text. Respondents clearly identified "methods" sections and references as likely areas of text matching,

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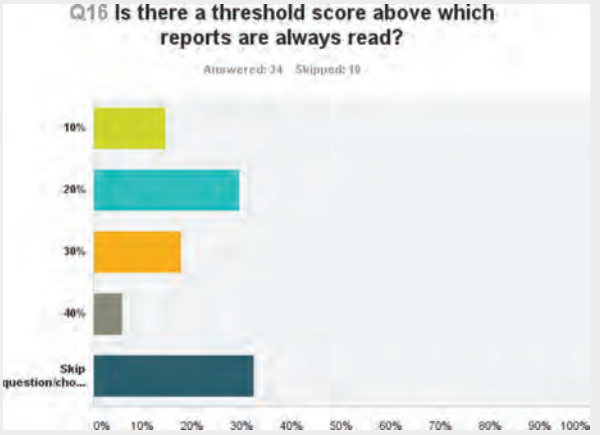

Figure 3. Graph of responses to Question 16: Is there a threshold score above which reports are always read?

and so reports would have to be analyzed to rule out these obvious sources.

Nearly 75% of respondents indicated a paper with an unacceptable (by their standards) level of text similarity would be rejected by their journal, but a large number would also recommend a "revise" decision, would ask the author to include appropriate citations during copyediting, or would put the paper on hold while the matter was investigated (Figure 4). Many would contact the author and explain the problem, even in the event of a rejection. In potentially serious cases of plagiarism, a few replied they would contact the author's institution. In cases where a problem has been identified, 40% of respondents allow authors to access the similarity reports themselves (i.e., by sending authors a PDF

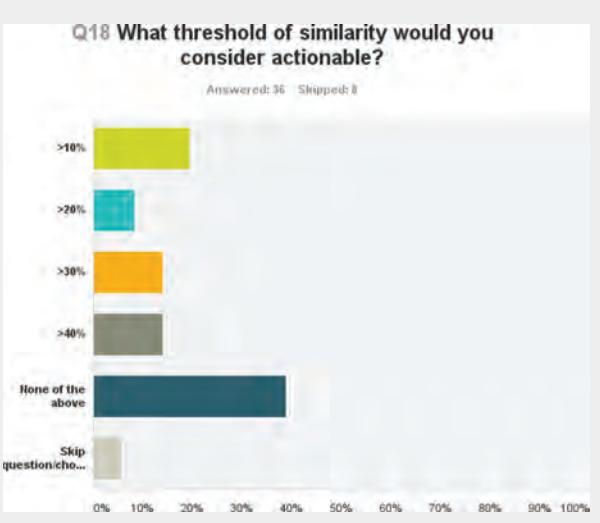

Figure 4. Graph of responses to Question 18: What threshold of similarity would you consider actionable?

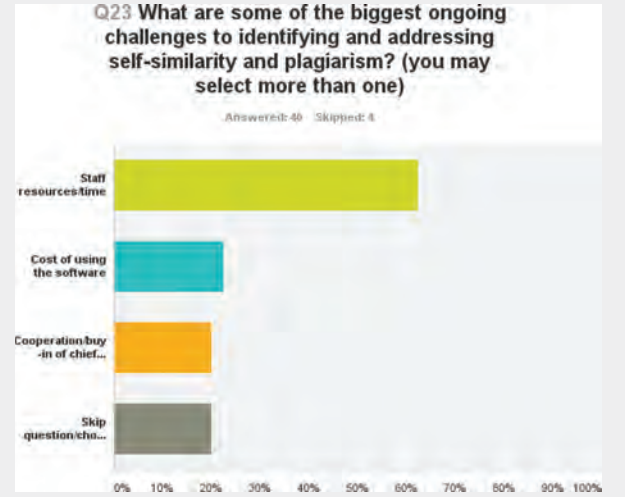

Figure 5. What are some of the biggest ongoing challenges to identifying and addressing self-similarity and plagiarism?

of the report). This allows authors to see exactly where the problems are and can help them better understand what they need to do to make their paper ready to pass peer review.

Twenty-five of forty respondents (62%; not all respondents answered all questions) identified staff resources and time as the biggest ongoing challenge to using SDS, followed by cost of using the software and editor cooperation (Figure 5). A number of comments pointed out that getting authors to understand what they might have done wrong—for example, it is not acceptable to reuse large sections of text from one's own articles—is one of the biggest challenges they face. Another challenge is the fact that these tools are deployed mainly at the discretion of the editors, each of whom may apply different standards and requirements to the papers submitted to their journals. A few noted the interface of the SDS was insufficiently user friendly, but this might improve as more publishers adopt the software, the interfaces become more intuitive, and users become more familiar with them.

Discussion and Conclusions

I originally hypothesized SDS users might have developed common approaches and even established some general standards for evaluating SDS reports and similarity scores. According to the survey results, SDS users have taken largely similar approaches to using these tools, but not in the way I imagined. Unexpectedly, there appears to be little consensus regarding the percent of text similarity that requires a particular action. The majority of the responses indicate that users are aware of the limitations of the similarity scores—that is, they reveal little about the extent of text recycling, much

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less plagiarism—and rather than check the reports only if they hit a certain score, *all* reports are carefully read.

Curiously, several comments stated it would matter whether the text was being reused from another work by the same author(s), rather than whether it was from so-called gray literature (e.g., dissertations/theses, conference materials) versus copyrighted published work (e.g., journal articles, book chapters). According to these respondents, self-plagiarizing is a less serious offense than reusing text from a source not authored by the same person.

For many of the survey questions, the answers boiled down to "it depends," which may indicate that not only are cases of text reuse and recycling being taken very seriously by publishers, but they are also being approached with great care and deliberation.

Clearly, more research is needed on this fertile topic. But a few general themes arise out of these data. There is quite a bit of consensus among respondents in how SDS tools are used. The challenges and limitations also seem to be fairly common across the board. Editors and others who use SDS are circumspect in its use and application to address potential problems in manuscripts. Many enlist the authors themselves to correct problems and make sure all references are appropriately cited prior to publication. The use of SDS is likely to increase in the future, and it will continue to be a powerful tool for educating authors about appropriate reuse of material as well as how best to avoid problems that can lead to ethical lapses and retractions.[6,7]

Sincerest thanks go out to all the survey respondents, as well as to Anna Jester for "boosting the signal" by mentioning the survey on her LinkedIn page. Special thanks also go to Gwendolyn Whittaker, AMS Peer Review Support Coordinator, for help in developing the survey questions. To view the full survey results, go to https://www.surveymonkey.com/results/SM-8RZXD2XB/.

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Reevaluating the Quest for Negative Results

Lenny Teytelman

In my experience as a researcher, science is a long stream of failures, interrupted by rare and brief moments of something working. The trial and error inherent in research produces a steady stream of negative results: the frequent experiments that should take only a week, and months later, you give up because you just cannot get biology to cooperate. Negative results can also occur when you try to follow up on something exciting that is published by another group but cannot reproduce their findings. Sharing such knowledge can be very valuable and can save someone else months or years of effort. Alas, such sharing is uncommon.

Let's set aside the instances where there is a need to contradict the findings of another scientist. In those cases, there is a legitimate fear of turning a colleague who reviews your grants and papers into an enemy.[1] Instead, I would like to discuss the larger space of null findings that are simply cases of wrong hypotheses or tricky method development.

In 1979, Robert Rosenthal coined the term "file drawer problem" when describing the preference of researchers to submit positive results for publication while locking the negative ones in a file drawer.[2] Analysis in the social sciences highlighted the level of self-censoring by researchers when it came to reporting the null studies,[3] as noted by Mark Pelow in *Nature News*:[4]

> *Of all the null studies, just 20% had appeared in a journal, and 65% had not even been written up. By contrast, roughly 60% of studies with strong results had been published. Many of the researchers contacted by Malhotra's team said that they had not written up their null results because they thought that journals would not publish them, or that the findings were neither interesting nor important enough to warrant any further effort.*

In an excellent editorial, Ivan Oransky and Adam Marcus wrote,[5]

> *That bias exists for many reasons, from the human desire to go for big, splashy stories, to the fact that successful clinical trials sell more reprints. And the bias drives research: When scientists know they need positive results to get into the big journals, which in turn earns them grants, promotions, and tenure, they'll be pushed in that direction. And it means that we need some serious efforts, and incentives, for publishing negative studies, to help balance out those directed at positive publications.*

Over the past 20 years, many approaches have been tried to correct the imbalance. Some important progress has been made, but overall, the valiant attempts to unleash the sharing of negative results have not delivered.

There Is No Shortage of Venues for Publishing Negative Results, Just a Shortage of Submissions

Because papers reporting negative results are cited much less than papers reporting positive ones,[6,7] high–impact-factor journals tend to reject them.[8] In response, many journals designed specifically for negative results have been launched. However, none have shown any real uptake (Table 1). It is telling that the most popular of these, the *Journal of Negative Results in Biomedicine* from Springer/BioMed Central (http://www.springer.com/biomed/journal/12952), ceased to publish in September of 2017.

In addition to journals explicitly dedicated to publishing negative results, the megajournal *PLoS ONE* was launched with such papers in mind, aiming to become the go-to place for these submissions. It did not happen, as Damian Pattinson, then editorial director of *PLOS ONE*, wrote in 2012:[9]

> *When PLOS ONE launched in 2006, a key objective was to publish those findings that historically did not make it into print: the negative results, the replication studies, the reanalyses of existing datasets. Although everyone knew these studies had value, journals would rarely publish them because they were not seen to be sufficiently important. PLOS ONE sought to become a venue for exactly these types of studies. As it happened, however, the submissions were not hugely forthcoming, although we have published a few.*

In addition to journals, unlimited space is available for easy sharing of negative results on preprint servers and document repositories such as figshare and Zenodo. In 2012, I cofounded protocols.io, an open access repository for research methods and protocols. Even though protocols.io welcomes negative results with open arms, less than 1% of the public methods shared on this platform seem to fall into this category.

What If the Funder Strongly Encourages the Sharing of Negative Results?

In 2015, the Gordon and Betty Moore Foundation announced an $8 million initiative to bring genetic methods to marine microbes.[10] These were high-risk grants focused on method development, with 100 labs working to get DNA into single-cell marine eukaryotes (protists) and perform genetic manipulation in different species.

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Table 1. Total number of papers published per year by each journal of negative results.

Year	JNRBM†	JNR	JPNR	NRSJ	All Results Journal: Chem	All Results Journal: Nano	All Results Journal: Bio	All Results Journal: Phys	Journal of Articles in Support of the Null Hypothesis
2002	2								7
2003	4								4
2004	7	2							3
2005	12	2							1
2006	19	1							4
2007	10	2							2
2008	12	2							1
2009	12	1							2
2010	10	1	11		1		0		3
2011	16	2	21		0		0	1	7
2012	16	2	12		0		0	0	4
2013	18	1	12		0		2	0	5
2014	18	0	13		0		4	0	4
2015	22	0	8		1	0	6	0	5
2016	21	2	11	0	0	0	7	0	5
2017	15	0	9	0	0	0	2	0	7

*JNRBM indicates *Journal of Negative Results in BioMedicine*; JNR, *Journal of Negative Results: Ecology and Evolutionary Biology*; JPNR, *Journal of Pharmaceutical Negative Results*; NRSJ, *Negative Results Science Journal*; Chem, chemistry; Nano, nanotechnology; Bio, biology; Phys, physiology.
†JNRBM shut down in September 2017.

The Moore Foundation also gave a grant to our protocols.io for the development of the online protist network (PROT-G) to support their researchers in collaborating and sharing experimental progress. One explicit goal of our grant was to "create an open and engaging virtual environment for sharing positive and negative results with active discussion groups that facilitate the exchange of ideas, tools, and techniques."

We worked very closely with the community and did everything we could to encourage the sharing of negative results along with the positive ones. While we had much success in facilitating collaboration, discussion, and rapidly sharing positive results, obtaining the negative results turned out to be even harder than we anticipated. In our mid-grant progress report to the foundation, we mentioned three challenges, with the first and most serious being the negative results:

> *The protocols.io platform was born out of the desire to make it easy to share improvement and optimization to existing methods. We feel that the interface does a good job of allowing this information to be shared. However, most tweaks and changes to existing methods do not result in improvements. Knowledge around what was tried and failed is also extremely useful for the community, however, it is unclear how to present this information and how to encourage scientists to share it.*

The PROT-G group is now two years old, and of the 150 methods shared there, fewer than 5 reported negative results. This is a collaborative community of researchers, easily sharing on an online platform that welcomes negative results, with strong encouragement from the funder. Yet, although we see plenty of sharing of negative results and difficulties in the discussion sections on the platform and in virtual conversations and in-person meetings among researchers, on the more formal reporting side, there is an overwhelming preference for sharing positive results.

If Your Goal Is Scientific Progress, Pursuing a Negative Result Can Be Distracting

Trying to understand the reservations of the protocols.io users about sharing negative results, we surveyed the protist

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researchers working on the Moore Foundation–funded effort. The responses were illuminating. Multiple senior and junior scientists told us a variant of the same concern.

You have a grant to try and tweak different existing techniques to introduce DNA into a specific protist species. You may be trying five different methods and varying dozens of steps in each one. Over the course of the year, you may have tried a hundred or more slightly different approaches, with only one of them working. The one that finally worked—you test it over and over, do proper controls, assess how robust it is. If it holds up, you share it with the community.

However, what do you do with the tentative negative result? Is it truly negative? You did not attempt it multiple times. Would it work in someone else's hands? Very possibly. Would it work in a closely related species, even if it does not work in yours? Often that is the case. The lack of confidence is a serious problem because as scientists, we set a high bar for reporting a finding. We hold ourselves to a standard, and it is very hard to push tentative results up to that level. The amount of work and time required to repeat and pursue each tentative negative variant is such that it would likely preclude ever finding the technique that actually works.

Discussing this concern with our graduate student and postdoctoral advisors at protocols.io confirmed this common obstacle, which is not specific to protist genetics method development. Whatever project you are passionate about and working on, you have a question or hypothesis and choose tools that are likely to help you answer it and make progress toward the answer. As you try previously reported techniques from other groups, you often do not obtain the same results. Then you are stuck—was the other group wrong, or is it you? Did you miss an important step in their protocol? Is the difference a consequence of ozone levels or different pipette tips in your lab? Do you spend the next year chasing the details of the previously published work, or do you set it aside and try another way to get closer to the answer you seek? (Also see Arjun Raj's, "Why there is no *Journal of Negative Results.*"[11])

Negative Results Are Important, but We Need to Rethink Our Approach to Them

The past five years of working on protocols.io have been educational and have given me a new appreciation for the many forces conspiring against the sharing of negative results. I still believe that they are important and that sharing them effectively can reduce the redundant effort and rediscovery that is common in science. As I have written before,[12] *PLOS ONE* has done a tremendous service to the research community by welcoming negative results from those who take the time to write them up. The problem is that most scientists will not write such papers.

It would be a disservice to science to push researchers into writing up tentative results on failures that may not be failures at all. If we want greater reproducibility in science, such a push would likely backfire. Nor do I think it is wise to steer scientists into more effort and work on techniques and approaches that seem to be unsuccessful at the expense of chasing the answers they actually dream about finding.

We can do better in facilitating sharing and collaboration, including the sharing of negative results. It will require brainstorming creative solutions by scientists, publishers, and funders, but it will not take the form of a sudden explosion of submissions to a journal of negative results.

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The Cuttlefish Problem: Readability and "Science-ese" in Scientific Writing

Kelly Tucker

In "Politics and the English Language," George Orwell's famous essay on the ills of modern English writing, the *1984* author declared, "The great enemy of clear language is insincerity. When there is a gap between one's real and one's declared aims, one turns as it were instinctively to long words and exhausted idioms, like a cuttlefish spurting out ink."[1]

As the essay title suggests, Orwell was mainly criticizing writing related to political matters, but the section on "pretentious diction" does call out scientific writing for that particular vice. The essay also contains Orwell's legendary list of six writing rules, one of which calls for avoiding jargon as much as possible (but not if doing so results in "anything outright barbarous"). Orwell's insistence on clear and accessible writing in the interest of the reader's understanding is still a worthy standard for any written work. Unfortunately, much of modern scientific writing is as obscured with jargon and garbled language as if it had been splattered with cuttlefish ink.

The most recent analysis of scientific writing's cuttlefish problem was published in eLIFE on September 2, 2017.[2] William Hedley Thompson and his colleagues from the Karolinska Institutet in Sweden sought to answer a seemingly simple question: Has scientific writing become harder to understand over time? The authors used the Flesch reading ease (FRE) formula and the new Dale-Chall (NDC) readability formula to measure the readability of over 700 000 abstracts for biomedical research articles published from 1881 to 2015 in 122 high-impact journals. The FRE formula was used to calculate readability scores based on the average length of sentences and words, and the NDC formula was used to calculate readability scores based on the number of "difficult" words used ("difficult" words were any words not on a prearranged list of "common" words).

The results were expected but still disappointing: Biomedical abstracts have become harder to understand.

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The average yearly FRE steadily fell while the average yearly NDC steadily rose. Approximately a quarter (26.5%) of the abstracts published in 2015 have FRE scores of <0, which indicates the writing is so difficult to read that even college graduates would likely struggle to understand the abstracts.[3] In contrast, only 16.3% of the abstracts published in 1960 had FRE scores of <0.

The authors attribute this decline in readability to the increasing use of both technical jargon and "science-ese," the authors' term for "general scientific jargon" (e.g., "furthermore," "somewhat," and "consequently"). Such words have become ubiquitous in scientific writing, but they require more effort to read and do not provide much value or meaning in return. As a paper accrues "science-ese," the reader must put more and more energy into understanding the text. Although some technical jargon is necessary and expected when writing on certain topics, "science-ese" is just fancy cuttlefish residue.

The repercussions of authors spurting jargon and "science-ese" are predictably counterproductive. Papers clogged with rambling sentences and clunky words are needlessly difficult for nonexperts to understand, and many readers may decide the article is not worth the headache. Perhaps worse is the increased risk that a reader will be confused or misinformed by the overwrought text, opening the door to flawed replication studies and inaccurate media reporting.

The study preprint has been reported on by several media outlets,[4–6] and this certainly is not the first time scientific

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writing has been scrutinized and found wanting.[7,8] A variety of resources are available for writers looking to get rid of pesky cuttlefish threatening to blotch their manuscripts,[9–11] but more needs to be done to encourage scientific writers to favor clarity over "science-ese."

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Editorial and Peer-Review Process Innovations: 2017 Peer Review Congress

Brittany Swett

The plenary session, "Editorial and Peer-Review Process Innovations," at the 2017 Peer Review Congress in Chicago, Illinois, in September 2017 presented research on innovation in peer review. The scholarly publishing community is experiencing increasing scrutiny of the idea, value, and implementation of peer review as a concept, from those both within and outside our industry. During this session, presenters shared their findings related to adapting the peer-review process in ways that speak to the questions about the validity and function of peer review. Each presentation demonstrated how flexibility in peer review can help the publication process respond to evolving needs in the scientific community.

Editorial Policy and Biomedical Research Reporting

Malcolm Macleod, representing the Nature Publication Quality Improvement Project (NPQIP) Collaborative Group, presented the first plenary abstract assessing whether a change in editorial policy could increase specific types of author reporting in manuscripts. The impetus for this study was the desire to increase author reporting of the measures they took to reduce the risk of bias in their study design, including randomization, blinding, sample size calculation, and exclusions. In 2013, Nature Publishing Group (NPG) began mandating that authors complete a 74-item checklist at revision submission indicating which of the four aforementioned criteria were included in their manuscript. (The current checklist used by *Nature* can be found online in the Life Sciences Reporting Guidelines section of the For Authors information page: https://www.nature.com/nature/for-authors/initial-submission.) NPG went from zero manuscripts meeting all four criteria before the implementation of the checklist to 17.1% of manuscripts being compliant after. This change was compared to the proportion of similar manuscripts meeting the criteria published in non-Nature journals before and after 2013, and those journals experienced no change (0.6% meeting all four criteria before compared with 0.5% meeting all four criteria after).

This outcome suggests the checklist and accompanying editorial policy had a positive impact on the number of *Nature* articles meeting key reporting criteria. It is important to understand the methods used by researchers to reduce the risk of bias and increase reproducibility of studies. In this study, an editorial policy implemented during the peer-review process addressed a need to ensure manuscripts clearly present study methods to better assess bias while simultaneously improving study reproducibility.

Perspectives from the Audience

The investment of staff time to enforce such a policy must be taken into consideration and balanced against the results.

It would be helpful to consider a way to simplify the checklist to make it easier for authors to complete and editors to assess.

Institutions and individual researchers must share in the responsibility to ensure researchers have taken measures to reduce bias in their study designs.

Signed Peer Reviews: Principle and Practice

The abstract presented by Elizabeth Seiver, Public Library of Science (PLoS) Researcher, and Helen Atkins, Director of Publishing Services at PLoS, described peer-review signing preferences on three PLoS medical journals: *PLoS ONE, PLoS Computational Biology*, and *PLoS Medicine*. Transparency in peer review was the topic of the concurrent 2017 Peer Review Week and was a ubiquitous topic at the 2017 Peer Review Congress. At the three PLoS journals assessed in this study, reviewers can choose to sign their comments to authors, thus revealing their identities, but neither reviews nor reviewer names are made publicly available. The authors of this abstract analyzed the rate at which reviewers had signed their review comments from mid-2013 to 2016. During this time period, 7.7% of reviews on three PLoS journals were signed. To obtain further information on author and reviewer preferences, Seiver and Atkins added survey links to existing emails generated by the submission system at the time of manuscript or review submission. From the results of these surveys completed by active reviewers and authors, PLOS found authors prefer signed

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reviews, which allow them to understand the experience and expertise of a reviewer commenting on their manuscript, as well as create opportunities for further open communication with the reviewer. However, reviewers indicated they prefer not to sign their reviews because they feel they can be more honest without fear of retribution for negative comments. Across the three journals in the survey sample, 47.5% of authors preferred to receive signed reviews, but only 15.8% of reviewers reported signing their reviews. Authors' desire for signed peer reviews is at odds with reviewers' reluctance to sign reviews.

For journals that want to increase the transparency of their peer-review process, the PLoS team recommends an easy first step: give reviewers the option to put their names on their reviews. Survey results revealed that many reviewers had never been given the opportunity to sign their reviews. Other considerations include the field of the journal community (reviewers in *PLoS Medicine* were more likely to sign their reviews than reviewers in the other two journals), provide incentives for signing reviewers, clearly articulate to reviewers the benefits of signing their reviews, and encourage reviewers to consider the author's perspective in their decision to sign a review.

Perspectives from the Audience

Publishers need to address the obvious dissonance between individuals' desires when they are authors and their actions when they are reviewers.

Allowing optional review signing will lead to situations where, on the same manuscript, one review may be signed and another may not. It will be necessary to assess the impact of optional review signing on author–reviewer interactions.

Role of Persistent Identifiers: Use of ORCID

Alice Meadows, Director of Community Engagement and Support at ORCID, discussed the integration of ORCIDs into the peer-review process and her findings on the uptake of linking peer-review activity through ORCID records since that feature's launch in 2015. From October 2015 to May 2017, more than 135,000 review activities were added to more than 9800 ORCID records by nine organizations. Peer-review activities must be connected to ORCID through an organization, such as a publisher or Publons; individuals cannot make these connections themselves. ORCID data from three organizations that were early adopters of ORCID (Publons, the American Geophysical Union, and *F1000*) were analyzed to see the rate of review activity linking. Publons was by far the top user of ORCID to connect peer-review activity, with 6.89% of Publons users having connected peer review activities to their ORCID records. This represents an overwhelming 92.8% of all review activities in ORCID.

The low uptake of this functionality indicates more education on this tool is needed to describe its functionality and benefits. Publons is one of the most important intermediaries between review activity and ORCID, so it will be interesting to see how Publons' purchase by Clarivate Analytics (owner of the ScholarOne manuscript submission platform) in June 2017 will impact uptake. The downstream implications of linking journal peer-review activity to a researcher's ORCID are the ability of that researcher to collate peer-review activities across publishers and to the share with stakeholders outside the publishing stream, including institutions and funders.

Perspectives from the Audience

Recording every review ever completed by a reviewer may be excessive and unnecessary. Perhaps not all scholarly activity should appear on an academic CV.

Researchers may be more willing to sign their reviews or participate in more transparent review if reviews received DOIs.

Researchers who are not scientists may feel left out of the conversations around ORCIDs.

Adding Patient Review Alongside Peer Review: A Mixed-Methods Study

The final abstract presentation was given by Fiona Godlee, Editor-in-Chief of *BMJ*, on the implementation and outcomes of a patient reviewer program as part of *BMJ*'s patient partnership strategy. For medical journals, patients are the ultimate beneficiary of scientific research. This premise fostered an ethical imperative within *BMJ* to invite patient voices and perspectives into the publication stream. *BMJ* has more than 600 patient peer reviewers, recruited through marketing efforts and physician contacts, and in 2016, 55% of research papers in *BMJ* sent to external peer review invited at least one patient reviewer to review. Interestingly, *BMJ* found patients agree and decline to review at rates similar to traditional reviewers. When editors were surveyed on the value of patient peer review in their experience, there were mixed results: five of seven responding research editors indicated that patient reviewers add "a little" value, and two of seven editors felt that patient reviewers added "a lot" of value to the peer-review process. Ultimately, four of seven editors felt that other journals should adopt patient review, and the other three were unsure.

Based on survey results from editors and patients (88% of responding patients believe more journals should have patient review), *BMJ* found that patient review is feasible despite its challenges and is desirable to most editors and patients. Challenges include recruiting patient reviewers, communicating with them during the peer-review process, and ensuring patient reviewers are not influenced by

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industry (e.g., in Europe, there are links between patient advocacy groups and industry).

Perspectives from the Audience

Resources for training patients on the basics of peer review (e.g., guides on peer-review process, important considerations in peer review) may be helpful to patient reviewers and editors.

Each of the abstracts described above, and all abstracts from the 2017 Peer Review Congress, can be found online at http://www.peerreviewcongress.org/pdf/2017/prc8-plenary-tuesday.pdf.

From Discovery—through Communication—to Application: Some Highlights of the 2018 AAAS Annual Meeting (Part 1)

The 2018 annual meeting of the American Association for the Advancement of Science (AAAS), held 15–19 February in Austin, Texas, bore the theme "Advancing Science: Discovery to Application" (Figure 1). Not surprisingly, given how discoveries come to be applied, many sessions dealt at least in part with communicating science. The following are highlights of some sessions science editors and those in related fields may find of particular interest. A report on additional sessions will appear in the next issue of *Science Editor*.

Figure 1. Exhibit hall during the 2018 AAAS Annual Meeting. Photo by Chantal Cough-Schulze.

"Trends in Visual Science Communication: Creating Inspiring, Informative Journal Figures"

By Mary Beth Schaefer

When preparing illustrations, as when doing research, scientists should plan carefully. This was the main advice from presenters Shiz Aoki, cofounder of the science illustration tool BioRender, and Savanna Jackson, user interface/user experience (UI/UX) researcher and designer with BioRender, at the session "Trends in Visual Science Communication: Creating Inspiring, Informative Journal Figures."

In part because most of us are visual learners, images are vital to science communication. However, many figures in papers submitted to journals lack quality. In fact, the presenters said, poor figures are a common reason journals reject papers.

Why are so many figures poor? Scientists face time and resource constraints, and few are trained in design, Jackson observed. She noted scientists spend much of their time carefully crafting an experiment and executing the procedure but generally put less care into creating figures. "Researchers work so hard on their actual science. Why can't it be presented beautifully?" she asked.

Design process

The presenters gave the following guidance for designing figures:

- To create an effective figure, first determine the purpose, just as when writing an article. The golden rule? Keep it simple. Have the image say one thing and say it well.
- Once the purpose is determined, write a thesis statement for the image. An example: "To highlight the differences in cell surface protein expression that result from 2 types of T-cell activation." Then, list the key elements needed to achieve the image's purpose. The presenters recommended using the fewest visual elements possible.
- Next, draw "a sketch—or 10," keeping in mind the first idea is rarely the best one. Ask a colleague to review a sketch of the figure to see how well it communicates.

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Design principles

The presenters also summarized principles of design. Some highlights:

- Minimize "visual noise"—elements distracting from the main message. Aoki noted some design features that have lost favor because they contain visual noise. These features include gradients (instead of flat colors), drop shadows, and stylized text, such as word art.
- Another design consideration is visual hierarchy, meaning what the viewer notices first in an image. For English-speaking audiences, visual elements usually should flow from top left to bottom right. Size, space, and color can draw attention to certain objects, and grouping can show that objects are related. Images also should be unified and consistent. Inconsistencies, such as using an arrow or color in different ways, create visual noise. And misalignment, even if slight, can distract viewers.
- In general, sans serif typefaces look more modern than serif typefaces, but the latter have their place (for example, if a document should look authoritative). And those designing figures need not shy away from big block letters, which can help show readers what is important.

Tools

The presenters noted several tools and resources, including a data-visualization page on the AAAS website (https://www.aaas.org/page/visualizing-data) and Twitter handles such as @iamscicomm. Before closing, the presenters demonstrated how to build a figure using BioRender (https://biorender.io; Figure 2), which has a library of science-related icons. Such resources can help scientists prepare effective figures despite lack of training and time.

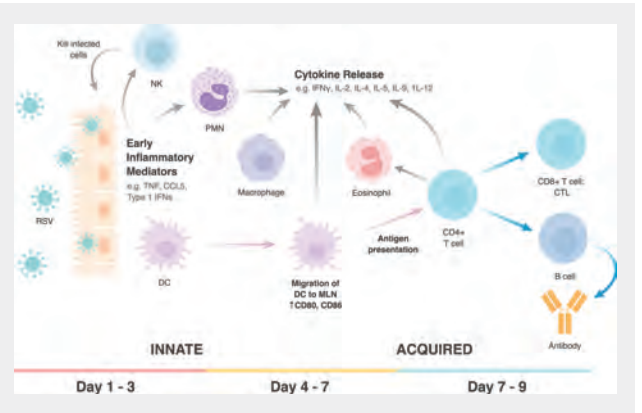

Figure 2. Speakers Shiz Aoki and Savanna Jackson used this image to demonstrate key design principles. The image was made with their company's graphics tool, BioRender, and is used with permission.

"Developing a Narrative About Your Data"

By Christina B Sumners

The three panelists at this session offered perspectives about the benefits and potential risks of telling stories, or developing narratives, about science. They also shared their experiences doing so and offered suggestions for best practice.

Michael E Webber, professor at the University of Texas at Austin, approached the topic as an academic interested in popularization. He said the "Carl Sagan effect" (the idea that those who communicate science to the public somehow are not "serious" scientists) is indeed real and lamented that, at least historically, such efforts have not counted much in decisions about tenure or awards. To keep people from thinking that someone who simplifies the science for a broad audience does not understand it, he suggested stating up front that what is being said is an oversimplification. Doing so will reassure the experts in the audience while not losing everyone else.

Karen Akerlof, visiting scholar at AAAS and a research assistant professor at George Mason University, described storytelling as so powerful, it's almost like drugs. "We are social creatures; when we engage in storytelling, it helps bind us to other people," she said. Whereas our ancestors would gather around the fire to tell stories, computer screens are our modem campfires, she added. Still, the basics have not changed: Good stories are set in a specific time and place, typically have a chronology with specific causations between events, and are populated with archetypal characters. Akerlof noted that highly cited journals tend to have articles with more narrative. She also emphasized why narrative should be important to academics: "If you land in the *The New York Times*, your citations will go through the roof, and your university will be very happy."

Joe Hanson, creator and host of the web video series *It's Okay to Be Smart*, said the human mind has traits science storytellers can use for good or evil: We love patterns, so much so we will find them everywhere, even in clouds or in craters on the moon. Also, we love stories; we innately think in stories, not in data points. Therefore, "you need to focus on building those stories, and your data is not your story, it's a character," he commented. Hanson also stated that the elements of storytelling, such as cliffhangers, can be great for stories about science. However, it's important to be careful: For example, although good narratives have conflict, to tell the story of how 97% of scientists agree climate change is happening and 3% disagree does a disservice to the situation and general scientific consensus.

To watch a video of this session or of the other two parts of the Communicating Science Seminar, visit the AAAS 2018 Annual Meeting Communicating Science Seminar web

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page (https://www.aaas.org/page/2018-annual-meeting-communicating-science-seminar).

"Exploring Public Fears and Myths: Vaccine Hesitancy, Food Safety in Fukushima, and Bacteria"

By Jessica Scarfuto

"It's a communication problem," said Thomas Hartung of the Johns Hopkins Bloomberg School of Public Health. This was the overarching theme of the three talks in this session. The speakers discussed reasons for public misconceptions regarding vaccines, food safety after the Fukushima nuclear reactor disaster, and the dangers of bacteria. They also discussed what to do to combat such misconceptions.

Hartung began the session by addressing why people tend to believe scientific fallacies on such topics. People receive a constant stream of poor information, misconceptions, and myths from family members, the media, and others, he observed. And although members of the public trust academic experts highly, studies indicate they seem to trust their peers the most. Also, scientists still do not know what causes autism, which has erroneously been linked to receipt of vaccines; thus, room exists for speculation among people looking for answers.

Miyoko Watanabe, senior executive of the Japan Science and Technology Agency, shared similar insights regarding public mistrust of food from Fukushima after the 2011 nuclear reactor disaster. Fukushima is famous for producing tomatoes, rice, peaches, and cucumbers, but after the nuclear disaster caused fears of radioactive contamination, members of the public worried the food might not be safe to eat.

"Unfortunately, the scientists caused public fear," Watanabe stated, saying the situation was poorly handled. The Japanese people apparently thought scientists could predict earthquakes, but the earthquake leading to the disaster was unpredicted. Scientists had also assured the public that nuclear power plants had very good safety systems in place, but the Fukushima plant did not. The resulting mistrust has been very difficult to rectify: Radiation levels have been rigorously measured throughout the region and multiple reports have confirmed the food is safe, but still the industry is suffering financially.

The last speaker, Catherine Buckley of University College Cork in Ireland, kicked off her talk by dropping a doughnut on the floor. There was groaning and somebody yelled "5-second rule!" but Buckley had a purpose for what seemed to be an act of clumsiness. "How many of you would have eaten that doughnut?" she asked. "And of those who said no, how many are scientists?" Buckley went on to note that the age-old 5-second rule lacks any validity but that not all bacteria are bad. In fact, she said, very few bacteria are pathogenic at all, and if we do not change our use of antibiotics, the number of deaths from antibiotic-resistant infections could rise to 10 million people per year by 2050, exceeding the annual number of cancer deaths.

So what can be done to counter such myths? As Hartung put it, "Scientists need to leave the ivory tower." With more transparency and social media communication, the speakers indicated, scientists can help ensure the public sees accurate information rather than the pseudoscience rampant on much of the Internet.

"What Citizens Think About Science: Survey Data and Implications for Communicators"

By Rachel Hoyle

At this session, speakers from the United States and United Kingdom discussed survey findings regarding public views of science. The first speaker, John Besley of Michigan State University, said attitudes toward science are positive and stable according to the Science and Engineering Indicators (a National Science Foundation report based on the General Social Survey, in which 3,559 face-to-face interviews were conducted in the United States). Most respondents agreed science is necessary, solves problems, and provides more benefits than harms. Moreover, respondents indicated they trusted scientific experts more than any other group about medical information, climate science, and the potential health risks of genetically modified foods.

Peter Muhlberger of the National Center for Science and Engineering Statistics, which developed the Science and Engineering Indicators, presented additional findings. He noted that when survey questions were worded to avoid triggering personal beliefs, Americans' responses resembled those from people in other countries.

Ethan Greenwood of the Wellcome Trust, Nick Allum of the University of Essex, and Patrick Sturgis of the University of Southampton offered findings from the Wellcome Trust Monitor (a survey involving face-to-face interviews with 1,179 adults and 374 youths in the United Kingdom). In the survey, more education—and consequently, higher socioeconomic class—was associated with greater science efficacy (that is, more factual information and understanding). The survey respondents reported they obtained most of their science information online; disparities by class or education did not seem to exist in this regard.

Cary Funk of the Pew Research Center presented highlights of the center's findings. She said the findings suggest that social and entertainment media are ways to reach beyond the active consumer of scientific information.

Based on the generally favorable survey results, Besley recommended a "less negative" stance when communicating science. Instead, he said to "articulate the great fortune we have to be in the scientific community."

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"Shooting Science: How to Design and Film Great Interviews"

By Cat Jackson

Filming a professional-grade interview can be daunting, but with new technology and some creativity, it is possible even without much experience, said Theo Lipfert, director of the School of Film and Photography at Montana State University. At this session, Lipfert discussed, and demonstrated with some of his graduate students, the three elements of a compelling filmed interview: lighting, audio recording, and interview technique (Figure 3).

Harsh fluorescent lighting is common in many workplaces, but it is unsuitable for filming. Lipfert stated, "Your mission is to control the light." He recommended turning off the lights, if possible, and using your own—a lighting rig can be constructed for less than $100. Also, some new gadgets, or simply black or white foam board, can be used to adjust the light.

Regarding audio quality, Lipfert commented that the number-one way to seem amateurish is to have the microphone visible. Too much sound pickup from the environment is another problem. One tip Lipfert offered was to run the lavalier microphone cord down the shirt of the wearer. Also, new software and hardware can improve sound quality, even when recording on an smartphone.

Lipfert also presented some interviewing tips: Let interviewees know that they should ignore the camera, that they can restate something if they wish, and that you will take longer-than-normal pauses to make editing easier. Lipfert further advised having the interviewee sit on a hardback chair, asking the interviewee to wear contacts instead of glasses if possible, and removing noisy jewelry.

Figure 3. A demonstration of interview techniques during the session "Shooting Science: How to Design and Film Great Interviews." Photo by Cat Jackson.

If the interviewee is long winded, Lipfert politely requests, "That was great. Could you say that in 2 sentences?"

"Best Practices in Communication and Outreach at Laboratories and Facilities"

By Barbara Gastel

This session centered on *Communications and Outreach for Science Laboratories and Facilities: Best Practice Advice for Directors, CEOs and Communications Managers* (https://www.interactions.org/bestpractices), a document from the Interactions Collaboration, which offers guidance for major particle physics laboratories internationally. The Collaboration has overseen peer reviews of communications and outreach at scientific institutions; the recommendations in the document emerged in part from these reviews.

The main author of the document, Terry O'Connor of the Science and Technology Facilities Council, United Kingdom, spoke first. He warned against assuming communication is effective. He then presented the document's recommendations: articulating and publishing the laboratory's vision and mission, having a comprehensive strategic communications plan, expressing a consistent and honest message, maintaining a close connection between management and communications leadership, ensuring budgets and structures reflect institutional objectives, understanding and prioritizing audiences, and challenging assumptions on internal communications.

Timothy Meyer, chief operating officer of Fermi National Accelerator Laboratory (Fermilab), discussed having experienced the peer reviews twice: first at the Canadian national laboratory TRIUMF and then at Fermilab in the United States. Meyer obtained the reviews shortly after arriving at the laboratories in order to both enlist external expertise and build cohesion with his team. After noting gaps the reviews uncovered, he mentioned the Fermilab review led to the laboratory's using its 50th anniversary as a way to reach new audiences.

Finally, Anne-Muriel Brouet of Ecole polytechnique fédérale de Lausanne, Switzerland, spoke from the perspective of a communications professional. She said she now sends news releases to all reporters on her list, rather than targeting subsets, as journalists prefer to decide for themselves what to cover. Also, rather than using a spokesperson, she has reporters speak directly to scientists. The scientists, however, receive guidance beforehand.

The question-and-answer period that followed included discussion of internal communications. It was noted that, because not all employees are office based, some messages should go out by multiple channels rather than only email. It was also noted that internal communications must be two way.

Topics of other communication-related sessions at the AAAS annual meeting included science fairs, social media, and fake news. For additional coverage, please see the next issue of *Science Editor*.

Author Surveys: Insights into Iterative Author Survey Campaigns

Jessica Rucker and Jody Plank

ACS Publications launched our rolling author surveys in 2015 with two main objectives in mind: 1) to give corresponding authors of each manuscript considered by one of our journals the opportunity to provide feedback on their experience, and 2) to collect that feedback over several years to allow for longitudinal analysis.

Within ACS Publications the decision to launch a rolling survey campaign was not taken lightly. There is legitimate concern regarding the number of surveys authors receive each year. The suggestion of adding yet another (or two or three, depending on an author's publishing frequency) should be considered carefully. Our marketing department conducts several targeted survey campaigns every year, each offering critical insight to a particular component of the publishing experience. However, the launch of rolling author surveys was justified by specific limitations of those traditional targeted campaigns.

Most survey campaigns do not provide authors with the chance to report on each of their manuscript submission experiences individually—with more than 50 journals in the ACS Publications portfolio, author experience can vary widely from journal to journal. In traditional targeted campaigns, authors' responses represent their cumulative author experience at ACS, not their experience with one particular journal or editor. Also, targeted campaigns render data sets that are too short to consider the long-term impact of changes within a publishing program—submission system functionality, editorial leadership, and advances in publishing technology, to name a few. Because those examples involve significant (and expensive) decisions, reporting on their effectiveness and impact is critical.

Thus, ACS Publications launched a rolling survey in the summer of 2015, inviting the corresponding author of every manuscript considered by one of our journals to provide feedback on their experience, regardless of whether the manuscript was rejected or published. Authors of rejected manuscripts receive a survey regarding their journal selection, submission, and peer-review experience. Authors of manuscripts that are accepted and published receive a survey with those same components, plus additional questions regarding their production and publication experience.

Nearly three years and tens of thousands of responses later, we have learned quite a bit—not just from the analysis our response data has afforded but also from the experience in general. What follows is our advice for anyone considering launching a similar campaign, interesting insights from our data, and some lessons learned worth sharing with anyone considering a similar endeavor.

JESSICA RUCKER is Assistant Director of Editorial Services, in the Publications Division of the American Chemical Society. JODY PLANK, PhD, is Manager of Products & Analytics, Editorial Services, in the Publications Division of the American Chemical Society.

Getting Things Started: Details to Consider

First, when embarking upon a survey effort of this magnitude, it is important to take inventory of your data infrastructure and determine points within the submission and publication process where there are reliable "triggers" for automating survey distribution. Assembling the right team to do this work is critical. At ACS, we are fortunate to have cutting-edge IT resources and a reliable data choreography that made automation possible. For manuscripts that are rejected, we determined the trigger would be the decision letter itself, with important timing considerations (addressed below). For accepted manuscripts, since we wanted to gather feedback on authors' production experience as well, we determined the trigger would be web publication. With these two triggers in mind, we set up scheduled reports that would "feed" our survey tool the information necessary to populate and send each survey.

We chose Survey Gizmo because of their robust integration options and proven ability to handle large-scale survey campaigns. The ability to design our survey to be consistent with the ACS Publications brand was essential. Most out-of-the box survey tools offer this feature, but we still mention it because it was a serious consideration for us given some of the predatory activities that impact our industry today. It was of paramount importance that our authors be able to identify with absolute certainty that our surveys are legitimate.

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It was not until develop ment of the technical foundation to support the survey was well underway that we begin drafting our survey content. As a project team, we dramatically underestimated the magnitude of this task. We highly recommend engaging with a firm that specializes in communicating with and seeking feedback from international audiences, as it is a delicate practice that should be approached carefully and with attention to both grammatical and cultural details. We learned during this step how nuanced the art of asking for feedback is, and how varied practices can be across geographic regions.

When drafting survey questions and response options, it is important to consider how those responses translate into data values, and ultimately how those values will meet your reporting needs. For example:

- Consider how you want to use/report the data before deciding on the question type. To understand how important several different aspects of the journal are to the authors, it may not be enough to have them assign a value to each aspect separately. It might be better if they rank the aspects from most to least important.
- In order to receive meaningful data values, response schemes such as "excellent, fair, poor, etc." should be consistent throughout the survey and correspond to numerical values for the purpose of reporting and analysis.
- Avoid using response schemes with an odd number, as the middle value offers little in the way of persuasive data, and many respondents will use that neutral option as a way to bypass the question, potentially watering down the response set.
- Provide a "N/A" option so respondents can bypass questions that did not apply to their experience (e.g., questions about peer review on manuscripts that were desk rejected).

The length of the survey is also an important consideration. Generally speaking, the longer the survey, the lower the response rate. It is important to look at the drafted survey and evaluate how important and "actionable" each question in the survey is. By "actionable" we mean, "Is there an action the organization can take if the authors give largely negative responses to the question asked?" Questions that fail to meet this standard will often increase the length of a survey at the expense of the completion rate without providing data of value.

> ***Test, test, and retest your surveys before launch, ideally with audiences that were not involved in the survey development.***

If you have specific reporting outcomes in mind, consider what information is contained in your survey distribution feed. We knew we wanted to report on survey responses at the journal and editor level, and we also wanted to look at responses based on whether manuscripts were peer reviewed. We set up our distribution feed to contain these data points so responses in Survey Gizmo could be matched to that information when surveys are returned. This has allowed us to filter our survey data to meaningful subsets of responses.

Finally—and perhaps it should go without saying—test, test, and retest your surveys before launch, ideally with audiences that were not involved in the survey development. Our project team was mortified to discover the word "survey" was misspelled in one of our test runs. Beyond the wording and survey functionality, test the data exporting and reporting steps to verify there are not any surprises in this area. It is important to verify the data will integrate with your reporting software (if applicable) and is capable of generating the graphs, reports, and comparisons that you seek. Do not skip or rush this step.

What Have We Learned?

By and large, our survey effort has been quite successful and has offered tremendous insights into how authors experience ACS as a publisher and where we stand to improve on that front. Still, we have learned a few important lessons from decisions that, if given the chance, we would not repeat in a future survey effort.

Our first lesson was particularly painful and involved poor timing regarding when our survey invitation was sent to authors whose manuscripts had been rejected. Since the surveys are sent regarding a specific submission, the journal name, manuscript title, and final decision are referenced in our invitation. We originally designed our rejection survey to go out one full day after the rejection decision was rendered by the editor, but in doing so we did not account for the fact that not everyone reads email on the weekend or while traveling. If an author did not check their email for two days, they would return to find our survey invitation higher up in their inbox than the actual decision letter (since emails are usually sorted chronologically) and discover their paper had been rejected by way of our survey invitation rather than the decision letter itself. Luckily (if you can call it luck), this issue surfaced relatively quickly, and we immediately adjusted our survey distribution settings so authors of rejected manuscripts are contacted two business days after the manuscript decision is communicated.

Our second major lesson was less painful, but equally surprising. When we launched our author surveys, we aspired to follow up personally with authors if such follow up seemed

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welcome and necessary. We provided respondents with the option to identify themselves by name and email address if they wished to be contacted regarding the feedback they provided. We were astonished to find that more than 35% of our respondents identified themselves and indicated their openness to being contacted. We expected only a handful of these respondents each month, and planned to coordinate with our editorial team to respond to the authors who wrote in about an experience they had with a particular journal. When hundreds and then thousands of responses rolled in, it became clear that our staff could not possibly keep up with our personal follow-up aspirations. We quickly disabled that feature in our surveys and looked for larger-scale ways to engage with our authors around some of the issues being raised—through social media, educational pieces, and posts to our ACS Axial page, for example.

The final lesson we will share here, which we are still struggling to address, is the complicated nature of "analyzing" open-text responses. Concerned that our radio button and ranking options would not adequately capture our authors' perspectives, we decided to provide opportunities for authors to explain their selections with open-text boxes at the end of each survey section. Many authors (we have observed over 50%) provide open-text responses to augment their response selections.

Our decision to provide open-text options at the end of each survey section compounded the issue; we have observed those authors who offer open-text responses do so repeatedly within the same survey. Combined, we have more than 34,000 survey responses and more than 32,000 open-text responses. Simple word-cloud analysis does not uncover trends in these responses. Instead, we have to take a targeted approach to analyzing this data (that is, manually dig through it) if we want useful information. For example, when we wanted to learn what our authors thought of manuscript transfer, we looked for responses containing terms relevant to manuscript transfer. Author quotes from that effort changed the way some of our editors looked at manuscript transfer as a practice and philosophy, so the digging was worth it. Still, we often feel we are doing those responses a disservice by not systematically analyzing them, and continue to evaluate our options to streamline our survey output on that front.

Even in facing these challenges, the results of our author survey continue to underscore the value of such a campaign. Iterative author surveys offer great insights into how you're doing as a publisher and can be a powerful tool in evaluating specific journals' and editors' impact on author experience. When done well, the results can inform important decisions around journal strategy and publishing operations.

The Fire of the Week: Managing Conflicts of Interest

Emilie Gunn

People sometimes ask me what I do, and I find this a challenging question to answer. In some ways, the answer is simple. As managing editor of an oncology journal, I oversee the functioning of that journal, help chart the course for its success, and ensure that all systems are running as efficiently as possible. But when pressed to explain what I do on a day-to-day basis (i.e., what specific tasks I perform), the answer becomes more complicated.

This is because each day is different, and like many of us, I am frequently confronted with problems that leave me wondering how to handle them. Unfortunately, these are often the same challenges that demand my attention RIGHT NOW. In my organization, we call these "drive bys," which occur when someone walks into your office (or sends an email), asking for your immediate attention on an urgent problem. Some organizations also refer to them as "fire drills."

When faced with these unique situations we have not seen previously, we may consider our options. We may ask ourselves, "Do I know anyone who may have seen this situation before?"; "Have I handled something similar in the past?"; or of course, "What would [PERSON'S NAME] do?" We may tap into our personal network or turn to others in our organization. As CSE members, we may send the question to the listserv to see if anyone has words of wisdom for us.

What is most important in these fire drills is not having all the answers, but rather having the resources to find them. With that in mind, this issue of *Science Editor* introduces a new column titled "Fire of the Week." This column offers a place to share those situations that leave you scratching your head, thinking, "Well, I've never heard that one before." Collective wisdom is powerful, and chances are, if you have experienced what you think is a unique situation, someone else has too. Why not share your experience so we all can benefit?

We want to hear from you. If you have recently encountered a particularly challenging or unusual situation, please tell us about it! To encourage submissions, we will even give you a handy template to follow.

I'll go first.

EMILIE GUNN *is education editor for* Science Editor *and managing editor for* Journal of Clinical Oncology *and* Journal of Global Oncology.

Describe the "Fire." What Happened? Who Was Involved? How Did the Situation Arise?

In 2015, our organization selected a founding editor in chief for a new journal. His selection came after a long, thorough search and interview process during which a committee of staff and members of our board of directors evaluated 10 applicants. The final selection was clearly the best choice for the job. The new editor gladly accepted the appointment. Unfortunately, as we prepared to make a public announcement of the editor's appointment, a member of the marketing team discovered this editor had some commercial interests that, while not strictly a conflict of interest given the subject matter of this journal, may be perceived as such.

Where Did You Go/What Resources Did You Utilize to Arrive at a Solution?

We quickly conferred with our in-house legal team, who presented a range of suggestions.

What Possibilities Did You Consider? Why Did You Decide Against Those?

We could offer the position to the runner-up applicant. We were not in favor of this, as we felt the candidate we already selected was the ideal choice. Another option was to ask the new editor to mitigate the appearance of conflict of interest by severing ties with the companies in question. Again, we felt this was not the best course of action, as the editor held significant interest in these companies and felt firmly dedicated to their success. The final suggestion was to offer him a shorter term than originally planned (2 years instead of 3), with no option for renewal. While this did not negate the conflict, it did reduce the amount of time the editor would be in control of the journal content.

How Did You Resolve the Problem? What Was the Outcome?

Ultimately, we went with the last option. This obviated the need to restart the editor search and allowed our first-choice candidate to assume the role of editor in chief. The only drawback was that it meant we would need to begin looking for the next editor in chief sooner than planned.

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Will You Change Any of Your Policies or Day-to-Day Procedures Based on This Occurrence?

This situation, while difficult, has informed our process for subsequent editor searches. We now incorporate a thorough check into any potential conflicts of interest into a much earlier stage in the search process. This allows us to consider other applicants if needed, and not find out when it is too late that our top choice may not be the ideal choice.

The Painful Publishing Process: A Request to Simplify Bureaucratic Requirements

Amanda Lorinc, J Matthew Kynes, and Camila B Walters

Publishing research is paramount to the advancement of medicine, and the peer-review process is critical for checks on research integrity. Although this process is over 300 years old and ubiquitous to scientific journals,[1] it remains decentralized and disjointed in a way that inhibits timely reporting of data. Many scientific journals require authors to format papers prior to submission, but this formatting is not standardized across journals. Formatting is arduous work—details that must be attended to prior to submission include line spacing, tables, and figures, among others. Attention to even minute details, such as whether superscripted numbers or parentheses are used for references, is required. Citation styles vary widely, from the American Psychological Association (APA), to Modern Language Association (MLA), to American Medical Association (AMA) style. Within six major anesthesiology-related journals, for example, four different reference styles and formatting requirements are requested (Table 1). After spending a day or more formatting a publication for submission, authors may be told days later the journal is not interested in publishing their article, and the time-intensive process of reformatting for another journal submission begins. This process is not cost effective, with an estimated US $272–$1400 per day lost in opportunity costs, costing the scientific community millions per year.[3] Further, in an era of increased scrutiny on publishing practices,[4] an inefficient submission process focuses energy away from assessing submission quality and integrity.

The current process adds unnecessary steps to academician workload at a time when burnout perception is high.[5] While manuscript formatting is not in and of itself a cause of burnout, young physicians in particular appear to be predisposed to burnout, and the pressure to publish for academic promotion is a substantial factor in this trend.[6] Physician burnout leads to fewer publications—an estimated 14.9% reduction over a 15-year period in one specialty alone.[7] In the absence of burnout, these young researchers may contribute to higher quality publications compared to their more established peers, making the loss of scientific discovery even more marked.[8] A system that actively facilitates the process for publication, rather than unintentionally obstructs it, could be an encouragement for young researchers and boon to publication and promotion.

Publishers have many reasons for developing and maintaining the guidelines that exist including electronic and print formats that evolved independently, a desire to appear distinctive among the plethora of available journals, and a lack of individual responsibility to incur the cost and time required to initiate change. An industry that relies on independent authors to produce its content, however, has a collective incentive to maximize efficiency in order to allow those authors to focus more on the quality of the content they produce. A few journals are leading the way to change this burdensome process, such as the *Journal of Pain*. Articles are reviewed prior to formatting and authors are informed of the journal's interest in the manuscript. This pre-peer-review process minimizes unnecessary time spent by the authors on bureaucratic tasks, which can be particularly frustrating when they learn their publication is not accepted shortly thereafter. We suggest all journals move to this pre-review process. Manuscripts should be read by journals to determine their interest in the topic and research prior to the authors spending time formatting. Further, the manuscript format for submission should be standardized. A multidisciplinary task force should be created to make recommendations for a standardized format to be adopted across the scientific community. The authors suggest the format in Appendix A as a first draft of this effort. Publication requirements and formatting may appropriately vary between journals, but a standardized and efficient process would shift the step of meeting these requirements from the period before submission to a point after acceptance for publication.

Optimizing the publication process could decrease opportunity costs and academician burnout, increase

AMANDA LORINC, J MATTHEW KYNES, and CAMILA B WALTERS are assistant professors at Vanderbilt University. They report no conflicts of interest and attest to the integrity of the manuscript. Camila B Walters is the archival author.

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Table 1. Selected author guidelines from six anesthesiology-related journals collected from submission websites.[a]

Journal (Publisher)	Sections	Reference Style	Citation Format	Submission Method	Other
Anesthesiology (Lippincott Williams & Wilkins)	Title page, structured abstract (most), body	Examples on website; list all authors	Numeral superscript	Editorial Manager®	Figures as .tif, .jpg, .pdf
Anesthesia & Analgesia (Wolters Kluwer Health)	Title page, abstract (most), body	AMA style; list authors up to 6, then first 3 followed by et al.	Numeral superscript	Editorial Manager®	EQUATOR checklist required; figures as .tif, .jpeg, .pdf, .pptx
Regional Anesthesia and Pain Medicine (Wolters Kluwer Health)	Title page, abstract, body	Examples on website; list authors up to 6, then first 3 followed by et al.	Numeral superscript	Editorial Manager®	EQUATOR checklist required; figures as .tif, .eps, .jpg, .pdf, .ppt, .doc
Critical Care Medicine (Wolters Kluwer Health)	Title page, structured abstract, body	Examples on website; refer to ICMJE.com	Numeral in parentheses in line with text	Editorial Manager®	Figures as .tif, .eps
Pediatric Anesthesia (Wiley)	Title page, structured abstract or summary, body	AMA style	Numeral superscript	ScholarOne Manuscripts™	Figures as .tif, .eps
Journal of Clinical Anesthesia (Elsevier)	Title page, structured abstract, body with numbered subsections	Examples on website; see ref. 2; list first 6 authors	Numeral in brackets in line with text	https://www.Evise.com	Figures as .eps, .pdf, .tiff, .jpeg

[a]AMA = American Medical Association, EQUATOR = Enhancing the Quality and Transparency of health Research Network.

physician satisfaction and the rate of research publication, and advance the field of medicine. As young scientists, we would like to initiate the conversation and request this positive peer-reviewed manuscript publishing system change. We request all scientific journals agree to a standardized submission format so we can focus on contributing to scientific knowledge and innovation.

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Appendix A. Suggestions for Standardized Manuscript Submission Format

Title Page

Author names in order of authorship, affiliations, author contributions, keywords, word counts, conflict of interest statement, manuscript type.

Abstract

Introduction

Methods

Results

Discussion

Conclusions

References and acknowledgements

References in National Library of Medicine (NLM) format (see http://www.nlm.nih.gov/citingmedicine)

Tables

Figures (submitted separately in .tiff, .jpeg, or .pdf)

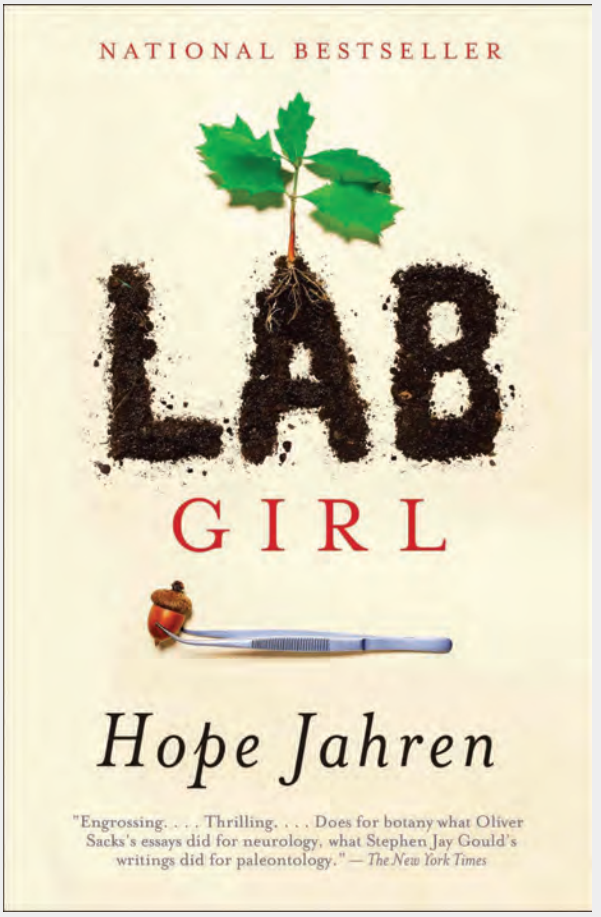
Appendices

All manuscripts should be in .doc format, double spaced, use Times News Roman font size 12, and have page numbers.

Book Review: *Lab Girl*

Anna Jester

Lab Girl. Hope Jahren. New York: Knopf, 2016. 304 pages. ISBN 9781101874936



Letters, words, sentences, chapters, figures, tables, articles, issues, books, and volumes—each of these items inform, sharing an anticipated quantity of truth, or perhaps notifying us that the "matching lid" we've been using has been misplaced. *Lab Girl* uses alternating chapters of personal and professional memoir (a format I greatly enjoyed) including "Part One: Roots and Leaves," "Part Two: Wood and Knots," and "Part Three: Flowers and Fruit," to weave a captivating and educational tale. Originally I listened to the audiobook version and delighted in the author's tone, slowing my intake in order to clarify some of the most meaningful accounts as they were recapped. I later added the hardback version to my bookshelf providing easy access to the excerpts; some hilarious and others cautionary. It also serves as a visual reminder for me to appreciate the fact that attending annual meetings rarely includes an icy road trip with peers (or in vans).

Jahren's love for the lab, and the story, get under way in her father's introductory physics and earth science lab at a Midwestern Community College. Her quest for knowledge leads to an increasingly widening radius of locations (UC Berkeley, Georgia Institute of Technology, Johns Hopkins University, and University of Hawaii) while simultaneously allowing her career, her laboratory, the navigation of the scientific grant obstacle course, and her keen writing of scientific papers to flourish. You will learn about, or be reminded of, botany while reading this book. Descriptions of cotyledons, inconceivably patient seeds, and tap roots all educate the reader while driving home points about the interconnected lives we lead.

> *Folded within the embryo are the cotyledons: two tiny ready-made leaflets, inflatable for temporary use. They are as small and insufficient as the spare tire that is not intended to take you any further than the nearest gas station. Once expanded with sap, these barely green cotyledons start up photosynthesis like an old car on a bitter winter morning. Crudely designed, they limp the whole plant along until it can undertake the construction of a true leaf, a* ***real*** *leaf. Once the plant is ready for a real leaf, the temporary cotyledons wither and are shed; they look nothing like all the other leaves that the plant will grow from this point forward.*
>
> —Hope Jahren

Extremely personal topics are also front and center in *Lab Girl* as the investigator and subject focuses the lens internally. Her relationship as part of an emotionally distant family provided just enough humor to promote introspection. Detailing her experience with mania in an exposing, while simultaneously educational, discourse took me by surprise and left me strikingly aware of how much we all have to learn. I hope she writes a sequel.

ANNA JESTER is Director of Sales and Marketing at eJournalPress.

Plenary Address: Survival of the Fittest: Evolution as Applied to the Future of Scientific Publishing

SPEAKER:
Marcia McNutt
President
US National Academy of Sciences

REPORTER:
Diane M Sullenberger
Executive Editor
National Academy of Sciences

Dr. Marcia McNutt, president of the US National Academy of Sciences (NAS), addressed the participants of the 60th CSE Annual Meeting on Tuesday, May 23. McNutt, who holds a BA in physics and a doctorate in earth sciences, has served as the director of the US Geological Survey (USGS), editor-in-chief of *Science*, and president of the American Geophysical Union (AGU). The focus of McNutt's talk was the crucial role of the publishing community in the scientific ecosystem. Throughout her presentation, she drew analogies between the evolution of a resilient ecosystem and a thriving scientific publishing community.

McNutt began by asking, "What does the future of scientific publishing look like?" Evolutionary change is often subtle and not easily seen if viewed too closely, and scientific publishing has experienced transitions akin to evolutionary shifts throughout its history. Currently, we are seeing the industry transform through the adoption of a preprint culture in the biological sciences, different models of open access publication, and new models of peer review. The editor of the first scientific journal, *Philosophical Transactions*, could not have imagined the evolution of the scientific publishing more than 350 years later. McNutt remarked, "Every time is a time of huge change."

McNutt noted that our goal in the scientific publishing community is to foster a strong and resilient publishing system. As an analogy, a thriving ecosystem is one that is diverse, contains redundancy, and has stable structure. A scientist studying ecosystems looks for these three attributes. Starting with diversity, McNutt drew parallels with publishing: Having a large number of scientific outlets for authors can boost productivity. There is a journal for every paper. Redundancy in a system can prevent a single point of failure. In an ecosystem, if disappearance of a single food source threatens the ecosystem, it lacks resilience. Scientific publishing, in comparison to the system for funding scientific research, is a far more resilient system. Investigators rarely have a diversity of options for agencies to fund their research if their proposal is rejected. In contrast, authors have the option of many tiers of publications for disseminating their research, such that any technically correct work will ultimately find an outlet.

> ***"Every time is a time of huge change."***

McNutt continued with a story about the wolves of Yellowstone National Park to illustrate the importance of a stable structure within an ecosystem. The wolves are keystone predators in Yellowstone. Without them, the population of grazers grew unchecked, causing an imbalance in the food chain, but their reintroduction stabilized the food chain and allowed the ecosystem once again to thrive. According to McNutt, stable structure in publishing is also necessary: Publishers need to ensure that all stakeholders in the publishing enterprise—authors, editors, publishers, funders, libraries, and institutions—execute their assigned roles with integrity and following agreed-upon rules and conventions. This promotes stability.

McNutt referenced the 2017 National Academies study *Fostering Integrity in Research*,[1] which describes the best practices and policies for all parties involved in scientific publishing. She noted that authorship policies must include appropriate disclosure of relationships and thwart ghost or honorary authorship. Detrimental research practices are a threat to the scientific ecosystem, so one recommendation from the NAS study is the creation of a Research Integrity Advisory Board, an independent nonprofit organization to foster research integrity across disciplines and all stakeholders. According to the study, a national-level body could work with public and private sectors to develop best practices and approaches as well as identify topics and questions related to improving research integrity.

Along similar lines, McNutt discussed a recent Sunnylands retreat with the editors and leaders of several journals and scientific societies to examine authorship standards, expectations for corresponding authors, and improving

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transparency in author contributions. The results of the retreat are documented in a preprint titled, "Transparency in Authors' Contributions and Responsibilities to Promote Integrity in Scientific Publication."[2] McNutt encouraged members of the CSE community to comment on the article.

> ***"Change is coming, and transparency is needed."***

The preprint advocates for advancing authorship standards, including electronic capture of author contributions in journal metadata. The authors also recommend that journals explicitly outline the responsibilities and expectations of the corresponding author, such as circulating drafts of the work to all coauthors, serving as a point of contact for the journal, and ensuring data, materials, or code are appropriately deposited or available. The CRediT taxonomy is suggested as an appropriate standard for authorship contributions, although it is only a first step in terms of capturing all of the details that authors may want to declare. ORCIDs are likewise recommended to disambiguate authors with common surnames and to provide a single, validated resource for discovering a researcher's publications and contributions. The preprint recommends that universities and research institutions regularly train and update researchers on the criteria for coauthorship to ensure appropriate authorship is established early on in a research project.

In her closing comments, McNutt offered the following quote, often attributed to Charles Darwin: "It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change." McNutt opined that the issue of authorship contributions is lagging behind and not leveraging currently available technologies. Further evolution must be supported and encouraged to maintain a vibrant publishing ecosystem. Increased transparency within the system is needed as, even within the scientific community, there are varying conventions related to authorship, disclosure, and access to data. McNutt concluded her remarks with the injunction "Change is coming, and transparency is needed."

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Updates on Open Access Journals

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The purpose of this session was to offer inspiration and guidance for organizations that are considering launching an open access (OA) journal and to inform attendees about the variety of OA models publishers and societies are leveraging, and how each are performing. Four speakers shared their organizations' success stories during this session and the lessons learned developing and maintaining a sustainable OA program. The speakers also presented information related to the different methods for generation of content for OA journals.

Helen Atkins, Director of Publishing Services at the Public Library of Science (PLOS), was the first speaker and she focused her presentation on what is beyond OA and where PLOS is heading next. Helen started by explaining that PLOS is a nonprofit publisher with a mission to accelerate progress in science and medicine by leading the transformation in research communication. As a result, PLOS is taking initiatives to increase research transparency through open access, open data, and credit. In 2016, PLOS published more than 27 000 articles contributed by authors from more than 190 countries. The articles have had over 12 million monthly online views and 2 million monthly downloads.

Helen explained that PLOS journals require authors to make all data related to the findings described in their manuscript fully available without restriction. When submitting a manuscript online, authors must provide a Data Availability Statement describing compliance with PLOS's policy.

Finally, Helen highlighted some digital tools that facilitate better credit and recognition such as ALMs, ORCID, CRediT taxonomy, and Data citations. Helen mentioned that PLOS was one of the original group of publishers to sign the ORCID open letter in January 2016. They were collecting ORCIDs in Editorial Manager, but many were not authenticated. PLOS finally made ORCID a requirement for corresponding authors at the beginning of December 2016.

PLOS has adopted the CRediT Taxonomy of author contributions: The submitting author will be responsible for completing this information at submission, and it is expected that all authors will have reviewed, discussed, and agreed to their individual contributions ahead of submission. Helen showed an example of how author contributions are published with the final article.

Suzanne Kettley, Executive Director of Canadian Science Publishing (CSP) presented updates on CSP's OA journals: *Arctic Science*, *FACETS* (Canada's first multidisciplinary OA journal), and *Anthropocene Coasts*. CSP is a modest-size publisher facing challenges such as global decline in subscriptions and the institution of OA requirements by Canadian funding agencies. CSP responded to those challenges by giving the authors different options for OA: 1) Authors could publish in one of the three fully OA journals, or 2) authors could choose the OpenArticle option in a subscription journal.

Suzanne presented results of an author survey on OA funding to explore whether their desire to publish OA was affected by their financial ability. Almost 70% would publish their research as OA but only 10–20% have the required funds.

CSP has an active content development program. When launching OA journals, CSP needed to generate both awareness of the new journals and new submissions. Their efforts included educational campaigns, promotional contests, article-level promotion, conference attendance, special issues, partnerships, and expanding the scope of the journal to react to the needs of the scientific community as disciplines grow (i.e., *FACETS*, originally launched with 6 subject pillars, is adding a 7th).

For OA journals, it is important to look beyond the impact factor and find other metrics, such as Altmetrics, that authors can take back to a granting or tenure committee. Also, the ability to reach a broader audience is appreciated by OA authors. CSP provides plain-language summaries on a special platform.

Finally, Suzanne outlined the next steps such as expanding *FACETS*, partnerships and community engagement, educational campaigns, and joining Open Access Scholarly Publishers Association (OASPA) and Directory of Open Access Journals (DOAJ).

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The third speaker was Darla Henderson, Assistant Director of the Open Access Programs at the American Chemical Society (ACS). Darla kicked off her presentation by identifying ACS as the world's largest scientific society and one of the world's leading sources of scientific information with 176 000 members. The ACS publishes over 40 000 manuscripts per year, of which, paid OA represents 1% of content in hybrid journals. ACS has adopted several strategies/initiatives to drive OA content. Darla explained the first of such strategies, expanding options. In the past three years, ACS expanded OA outreach, launching several new programs and journals, including the following:

- *ACS Central Science* (ACS' first fully OA journal): Publishes research that highlights the centrality of chemistry
- ACS Author Rewards: A program worth $60 000 000 in credits to be used by ACS authors over two years to assist in the purchase of OA options
- ACS AuthorChoice: ACS provides various licenses to help authors choose the best option that suits their needs
- *ACS Omega*: ACS's second fully OA journal is aimed at publishing technically sound research with a focus on expedited editorial decision making

Darla elaborated on *ACS Omega* by mentioning that it is publishing about 600 manuscripts/year right now (about 1.5% of ACS's total published manuscripts). In its first partial year, it published about 100 manuscripts (or 0.25% of the total published manuscripts).

The next strategy Darla discussed was streamlining workflows, including adding services such as ORCID, Ringgold, and Rightslink. The biggest improvement would be a direct system for moving a paper from one ACS journal to another.

Another strategy is that ACS has embraced partners by joining OA organizations and initiatives, such as CHORUS, and worked with their community (e.g., significant discounts for ACS members and authors at institutions that subscribe to ACS's All Publications package). ACS also gives a 50% discount to members. Their platinum OA journal has an average article processing charge (APC) around $800. They also give two APC credits to authors who publish with them. As part of the previously mentioned streamlining workflows, Copyright Clearance Center manages all of these processes for ACS.

Also, ACS has agreements with funders/foundations to support OA (possibly to cover the cost for authors who cannot pay). These agreements resulted in ACS establishing new relationships with funding agencies and new key stakeholders. In addition to that, ACS partners with authors to allow them to experience OA and understand its benefits.

Other initiatives ACS has undertaken add value including promotional activities and programs such as ACS Editors' Choice. This is a program in which ACS journal editors recommend articles that should be OA and ACS then sponsors one new OA article every day of the year. ACS deposits published articles with aggregators, and any updates, and tracks data on the articles.

Feedback from authors has indicated true culture change: Almost 50% of the chemistry authors in the US and Japan, 40% in China, and a surprising 68% in Germany and the UK indicated that they published their research in a fully OA journal.

The key ACS outcomes of the OA initiatives have been revenue growth in OA well ahead of the science, technology, and medicine marketplace, establishing a diverse revenue stream, growth in the output of OA from 1% to 7% of newly published articles in hybrid journals. Also, the new fully OA journals are now publishing content not previously captured (i.e., growth in submissions) while established hybrid journals continue to serve communities in a different environment.

When Patty Baskin, Executive Editor, *Neurology*, American Academy of Neurology (AAN), joined the AAN in 2007, she worked with the editors to devise a strategic plan. Some of the elements included putting AAN in the position of 1) increasing international outreach, 2) expanding AAN's portfolio to subspecialties in neurology, 3) reaching new audiences in basic science areas related to neurologic disease, and 4) developing new sustainable business models for publishing. According to this plan, two new OA journals and one hybrid OA journal have launched within the last few years. Patty explained that there is a lot to think about when launching a new journal. The process starts with editor and staff selection; a dedicated editor with a vision is a must. Next, there were operational meetings to design the new workflow (dedicated staff). However, the most important step was content planning as getting the first few articles was difficult. The editor had to solicit content from colleagues and papers submitted to *Neurology* were trickled down to the subspecialty journals. This movement benefitted from re-using the reviews for the 2nd and 3rd journals, although additional reviews were sought.

Baskin then explained why AAN launched specialty/niche journals rather than just one general OA journal. *Neurology* has received many papers in some subspecialties (e.g., multiple sclerosis and other neurological diseases, and genetics topics). Their top-tier journal was rejecting many high-quality papers, enough to start new journals. Market research before the launches indicated that the new OA journals would be filling a gap, as rejected papers were being accepted, published, and then cited in other journals.

The major challenge that editors faced was how to encourage authors to submit to a new journal that has no

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reputation, is not yet indexed in PubMed, and does not yet have an impact factor. Also, having to pay for papers to be published as opposed to free publication in *Neurology* required a change in the mindset of authors. Consequently, the promotional activities included calls for papers, increasing visibility at conferences, reaching out to potential authors, applying for acceptance in PubMed, and soliciting well-known members in the research areas for editorial boards.

Those efforts resulted in the new journals having a large number of international submissions (from 43 nations), international editorial boards, and a rapid growth in manuscripts submitted per year (which resulted in a decreasing acceptance rate each year). The journals are now deposited in PubMed, DOAJ, Scopus, and Web of Science.

Patty's final advice was for publishers to look for ways to reduce the APCs for authors and to be patient when starting a new OA journal.

The ST in STM: Overcoming Challenges in Non-Medical Publishing

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BSA finds that grass-roots marketing efforts speak to their community. Members launched an #IamaBotanist Twitter campaign, which carried through the "March for Science" that took place in cities nationwide in April 2017. Photo Credit: Courtesy of the *Plant Science Bulletin*, Botanical Society of America.

This session offered a peek behind the curtain of the day-to-day challenges of non-medical journals in Scientific, Technical, and Medical (STM) publishing. Those of us who work in science and technology face some challenges that are different than those in the medical disciplines.

Ken Heideman of the American Meteorological Society spoke of the issues around open access (OA). He admitted that non-medical journals may be asking themselves: "Why are we being dragged into this?" This is a fair question. After all, OA came out of National Institutes of Health (NIH) policies and the desires of the biomedical field.

Angela Cochran from the American Society of Civil Engineers (ASCE) shared the same sentiments. The civil engineers largely believe that anyone who needs access to content has access to content. Members report a distrust of OA journals, in part because of the large amount of spam messages they receive from less than reputable OA journals.

Amy McPherson from the Botanical Society of America (BSA) said that her members like the idea of OA, but they do not understand why it costs so much (or why it is not free). The Society has kept author publication charges (APCs) low at its primary journal, the *American Journal of Botany* (a hybrid subscription journal, which discounts fees for BSA members), and its sister publication *Applications in Plant Sciences* (launched in 2014 as a completely OA journal). The members are sensitive to their colleagues who are not well funded and worry that charging too much for APCs is at odds with their mission to be inclusive of researchers all over the world.

AMS and the BSA have both launched OA journals that have proven successful. "AMS now sees OA as a good business model and a good thing," said Heideman. Uptake of OA has been impressive with 18% of the new content publishing as OA through the Open Choice hybrid option.

ASCE also gives authors a choice of OA, but has only seen modest interest with 1.5% of papers publishing OA, reported Cochran. She said that civil engineers have been slower to adopt OA partly because of the large amount of emails they receive from questionable OA journals.

McPherson and Cochran also spoke of the advantages and disadvantages of having smaller communities. While medical communities can certainly splinter into niche groups, BSA enjoys smaller, more focused groups that respond well to grassroots marketing and engagement.

Despite civil engineering being a very large field, ASCE has nine Institutes that operate like mini-societies within the society. Cochran spoke about the challenges of these small communities overlapping with non-engineering groups, like the environmental engineers with chemists or

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the mechanical engineers with physics. These members get a taste of what other communities have adopted as their practices and it can present challenges for maintaining homogenized practices within ASCE.

Funding was also an important topic of discussion. McPherson spoke of the limitations of having members and authors who are not well funded. Initiatives and services that BSA could develop at a cost to the user can be difficult to get started.

Cochran sees challenges in increases in funding from outside the US. "It's clear from the papers we receive from China that the Chinese government is funding [research and development] in infrastructure… at levels not happening in the US," Cochran said. While the journals remain more closely tied to funding policies from the US, attention needs to be paid to China and increasingly the Middle East.

While there are many similarities across STM publishing disciplines, many of the best practices, guidelines, and access policies are being driven by the medical disciplines. These sometimes put non-medical organizations, which may have different needs, at a disadvantage. On the flip side, often problems can be worked out with the medical journals before the non-medical ones need to make changes.

At the end of the day, all of our journals are beholden to a community. "We are really trying to make it clear, what the added value is—what authors get for their money," Heideman said.