Penn Science Policy Group

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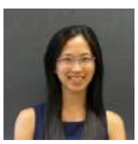

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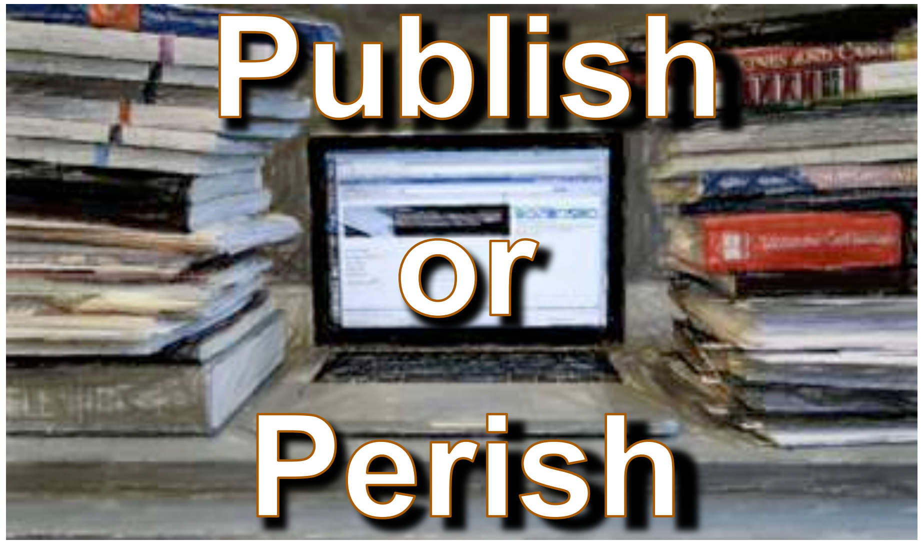

An old system adapting to the digital era

by Annie Chen and Michael Allegrezza

When scientific publishing was developed in the 19th century, it was designed to overcome barriers that prevented scientists from disseminating their research findings efficiently. It was not feasible for scientists to arrange for typesetting, peer review, printing, and shipping of their results to every researcher in their field. As payment for these services offered by publishers, the researchers would transfer the exclusive copyrights for this material to the publisher, who would then charge subscribers access fees. To limit the printing costs associated with this system, journals only published articles with the most significant findings. Now, nearly 200 years later, we have computers, word processors, and the Internet. Information sharing has become easier than ever before, and it is nearly instantaneous. But the prevailing model of subscription-based publishing remains tethered to its pre-digital origins, and for the most part these publishers have used the Internet within this model, rather than as a tool to create a new and better system for sharing research.

In theory, digitization should have decreased costs of communicating science: authors can perform many of the typesetting functions, articles can be uploaded online instead of printed and shipped, etc. In practice, however, digitization has actually *increased* the price of journals. Statistics from the Association of Research Libraries show that the amount spent on serials increased 6.7% per year between 1986 and 2011,while inflation as measured by the US Consumer Prices Index only rose 2.9% per year over the same period (**Figure 1**).[1] Shawn Martin, a Penn Scholarly Communication Librarian, explained, "Penn pays at least twice for one article, but can pay up to 7 or more times for the same content," in the process of hiring researchers to create the content, buying subscriptions from journals, and paying for reuse rights. To be fair, the transition phase from print to digital media has been costly for publishers because they have had to invest in infrastructure for digital availability while still producing print journals. Many publishers argue that while journal prices may have increased, the price per reader has actually decreased due to a surge in the ease of viewers accessing articles online.

Regardless of whether increasing journal prices was justified, a new model for academic publishing emerged in the 1990s in opposition: open access (OA). There are two ways of attaining open access: Gold OA, when the publisher makes the article freely accessible, and Green OA, which is self-archiving by the author. A few years ago, Laakso *et al*. conducted a quantitative analysis of the annual publication volumes of Direct OA journals from 1993 to 2009 and found that the development of open access could be described by three phases: Pioneering (1993-1999), Innovation (2000-2004), and Consolidation (2005-2009).[2] During the pioneering years, there was high year-to-year growth of open access articles and journals, but the total numbers were still relatively small. OA publishing bloomed considerably from 2000 to 2009, growing from 19,500 articles and 740 journals to 191,850 articles and 4,769 journals, respectively. During the innovation years, new business models emerged. For example, BioMedCentral, later purchased by Springer in 2008, initiated the author charge. In 2004, some subscription-based journals began using a hybrid model, such as Springer's Open Choice program, which gave authors the option of paying a fee to make their article openly available. During the consolidation phase, year-to-year growth for articles decreased from previous years but was still high, at about 20%.

The introduction of open access journals has sparked fierce and passionate debates among scientists. Proponents of open access believe scientific research should be available to everyone from anywhere in the world. Currently, subscription fees prevent many people from accessing the information they need. With open access, students and professors in low- and middle-income countries, health care professionals in resource-limited settings, and the general public would gain access to essential resources. For instance, Elizabeth Lowenthal, MD, at the Penn Center for AIDS Research, recently published a paper in PLoS One analyzing variables that influence adherence to retroviral drugs in HIV+ adolescents living in Botswana. Her decision to publish open access was because "the article will be of most direct use to clinicians working in Botswana and I wanted to make sure that it would be easy for them to access it." Open access also provides re-use rights and may facilitate a more rapid exchange of ideas and increased interactions among scientists to generate new scientific information.

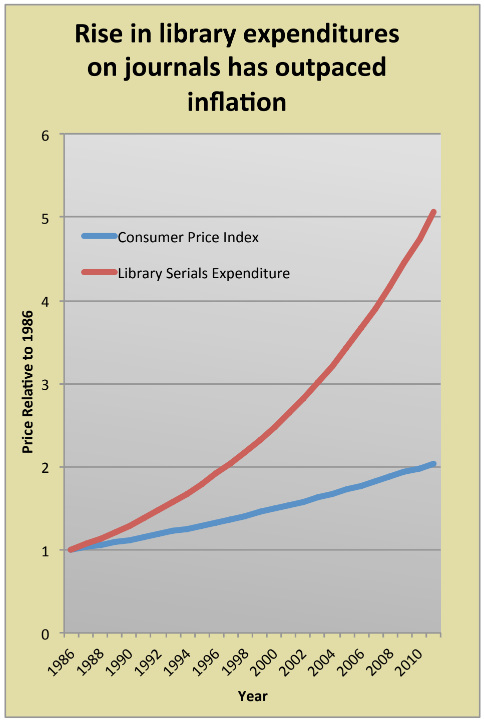

Figure 1. Trend lines show an annual increase of 6.7% for serials expenditures vs 2.9% for the Consumer Price Index over the period 1986-2010, relative to 1986 prices.

However, there may also be some downsides to increased access. Open access may increase the number of articles that people have to sift through to find important studies.[3] Furthermore, people who do not know how to critically read scientific papers may be misled by articles with falsified data or flawed experiments. While these papers often get retracted later on, they may undermine the public's confidence in scientists and medicine. Wakefield's (retracted) article linking vaccines to autism, for example, may have contributed to the rise of the anti-vaccine movement in the US.[4] Furthermore, many open access journals require authors to pay for their papers to be published to offset the cost of publication, and some people have taken advantage of this new payment system to make a profit through predatory journals (a list of predatory OA journals can be found here: http://scholarlyoa.com/publishers/). It is clear though, that the expansion of open access from 1993 until present time suggests that open access can be a sustainable alternative to the traditional model of subscription-based academic publishing.

In addition to facilitating access to scientific articles, the Internet has also created opportunities to improve the peer review process. Peer review was designed to evaluate the technical merit of a paper and to select papers that make significant contributions to a field. Scientists supporting the traditional model of publishing argue that the peer review process in some open access journals may not be as rigorous, and this may lead to the emergence of a "Wild West" in academic publishing. Last year, reporter John Bohannon from *Science* magazine sent a flawed paper to 304 open access journals, and of the 255 journals that responded, 157 accepted the paper, suggesting little or no peer review process in these journals.[5] However, even high-impact journals publish papers with flawed experiments.[6] Michael Eisen, co-founder of PLoS, wrote, "While they pocket our billions, with elegant sleight of hand, they get us to ignore the fact that crappy papers routinely get into high-profile journals simply because they deal with sexy topics…. Every time they publish because it is sexy, and not because it is right, science is distorted. It distorts research. It distorts funding. And it often distorts public policy."[7] *Nature*, for example, published two articles last year about acid-bath stem cell induction, which were later retracted due to data manipulation. However, according to Randy Sheckman, editor-in-chief of eLife, "these papers will generate thousands of citations for *Nature*, so they will profit from those papers even if they are retracted."[8]

With digital communication, peer review for a manuscript could shift from a rigid gate controlled by 3 or 4 people, who might not even be active scientists, into a more dynamic, transparent, and ongoing process with feedback from thousands of scientists. Various social media platforms with these capabilities already exist, including ResearchGate[9] and PubMed Commons.[10] Some open access journals are using different strategies to address these issues in peer review. eLIFE, for example, employs a fast, streamlined peer review process to decrease the amount of time from submission to publication while maintaining high-quality science. On the other hand, PLoS One, one of the journals published by the Public Library of Science, judges articles based on technical merit alone, not on the novelty.

We polled a few scientists at Penn who had recently published for their thoughts on open access and peer review. Most people did not experience a difference in the peer review process at an open access journal compared to non-open access. The exception was at eLIFE, where reviewers' comments were prompt, and the communication between reviewers and editors is "a step in the right direction," according to Amita Sehgal, PhD. To improve the peer review process, some suggested a blind process to help eliminate potential bias towards well-known labs or against lesser-known labs.

The digital revolution is changing the culture of academic publishing, albeit slowly. In 2009, the NIH updated their Public Access Policy to require that any published research conducted with NIH grants be available on PubMed Central 12 months after publication.[11] Just last month, the publisher Macmillan announced that all research papers in *Nature* and its sister journals will be made free to access online in a read-only format that can be annotated but not copied, printed or downloaded. However, only journal subscribers and some media outlets will be able to share links to the free full-text, read-only versions.[12] Critics such as Michael Eisen[13] and John Wilbanks[14] have labeled this change merely a public relations ploy to appeal to demands without actually increasing access. It will be interesting to see if other publishers follow this trend.

Scientific communication has yet to reap the full benefits in efficiency made possible by the Internet. The current system is still less than ideal at furthering ideas and research with minimal waste of resources. But this generation of young researchers is more optimistic and may revolutionize scientific publishing as we know it. "I think [open access is] the future for all scientific publications," says Bo Li, a postdoc at Penn. "I hope all research articles will be freely accessible to everyone in the world."

[1]Ware M, Mabe M. (2012) The stm report. http://www.stm-assoc.org/2012_12_11_STM_Report_2012.pdf
[2]Laakso M, Welling P, Bukvova, H, *et al*. (2011) The development of open access journal publishing from 1993 to 2009. *PLoS ONE*.
[3]Hannay, T. (2014) Stop the deluge of scientific research. *The Guardian*: Higher Education Network Blog. http://www.theguardian.com/higher-education-network/blog/2014/aug/05/why-we-should-publish-less-scientific-research.
[4]Wakefield AJ, Murch SH, Anthony A, Linnell, *et al*. (1998) Ileal lymphoid nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children [retracted]. *Lancet*. 351:637-41.
[5]Bohannon, J. (2013) Who's afraid of peer review? *Science*. 342(6154): 60-65. DOI: 10.1126/science.342.6154.60
[6]Wolfe-Simon F, Switzer Blum J, Kulp TR, *et al*. (2011) A bacterium that can grow by using arsenic instead of phosphorus. *Science*. 332 (6034) 1163-6. doi: 10.1126/science.1197258.
[7]Eisen M. (2013) I confess, I wrote the Arsenic DNA paper to expose flaws in peer-review at subscription based journals. *it is NOT junk*. http://www.michaeleisen.org/blog/?p=1439.
[8](2014) Episode 12. *The eLIFE podcast*. http://elifesciences.org/podcast/episode12
[9]ResearchGate. http://www.researchgate.net/
[10]PubMed Commons. http://www.ncbi.nlm.nih.gov/pubmedcommons/
[11]NIH Public Access Policy Details. http://publicaccess.nih.gov/policy.htm
[12]Baynes G, Hulme L, MacDonald S. (2014) Articles on nature.com to be made widely available to read and share to support collaborative research. *Nature*. http://www.nature.com/press_releases/share-nature-content.html
[13]Eisen M. (2014) Is Nature's "free to view" a magnanimous gesture or a cynical ploy?. *it is NOT junk*. http://www.michaeleisen.org/blog/?p=1668
[14]Van Noorden R. (2014) Nature promotes read-only sharing by subscribers. *Nature*. http://www.nature.com/news/nature-promotes-read-only-sharing-by-subscribers-1.16460

The Richest Return of Wisdom

by Brian S. Cole

The real lesson I've gleaned from my time in pursuit of a PhD in biomedical research hasn't been the research itself; indeed many of my colleagues and I came into the program already equipped with extensive bench experience, but the real eye-opener has been how science is communicated. When I was an undergraduate, assiduously repeating PCR after PCR that quietly and dutifully failed to put bands on a gel, I just assumed that experiments always worked in the well-funded, well-respected, well-published labs that wrote the papers we read in school. As an undergraduate, I had implicit trust in scientific publications; at the end of the PhD, I have implicit skepticism. It turns out I'm not alone.

The open access movement has taken a new tone in the past year: increasing recognition of the irreplicability[1] and alarming prevalence of scientific misconduct[2] in highly-cited journals has led to questioning of the closed review process. Such a process disallows the public access to reviewers' comments on the work, as well as the editorial correspondence and decision process. The reality of the publication industry is selling ads and subscriptions, and it is likely that editors often override scientific input by peer reviewers that throws a sexy new manuscript into question. The problem is the public doesn't get access to the review

The real eye-opener has been how science is communicated

process, and closed peer review is tantamount to no peer review at all as far as accountability is concerned.

For these reasons, our current scientific publication platform has two large-scale negative consequences: the first economic, and the second epistemic. First, intellectual property

We should be thinking about the benefit of the networked consciousness of online collectivism

rights for publicly funded research are routinely transferred to nonpublic entities that then use these rights for profit. Second, there is insufficient interactivity within the scientific community and with the public as a result of the silo effect of proprietary journals. The open access revolution is gaining momentum on the gravity of these issues, but to date, open access journals and publishers have largely conformed to the existing model of journals and isolated manuscripts, and while open access journals have enabled public access to scientific publications, they fail to provide the direly needed interactivity that the internet enables.

In the background of the open access revolution in science, a 70 year old idea[3] about a new system for disseminating scientific publications was realized two decades ago on a publicly licensed code stack[4] that allows not just open review, but distributed and continuous open review with real-time version control and hypertext interlinking: not just citations, links to the actual source. Imagine being able to publish a paper that anybody can review, suggest edits to, add links to, and discuss publicly, with every step of that ongoing process versioned and stored. If another researcher repeats your experiment, they can contribute their data. If you extend or strengthen the message of your paper with a future experiment, that can also be appended. Such a platform would utterly transform scientific publication from a series of soliloquies into an evolving cloud of interlinked ideas. We've had that technology for an alarmingly long time given its lack of adoption by researchers who continue to grant highly cited journals ownership over the work the public has already paid for.

I've kicked around the idea of a Wikiscience[5] publication system for a long time with a lot of scientists, and the concerns that came up were cogent and constructive. In testament to the tractability of a wiki replacement for our system of scientific publication is Wikipedia, one of the greatest gifts to humankind ever to grace the worldwide web. The distributed review and discussion system that makes Wikipedia evolve does work, and most of us are old enough to remember a time when nobody thought it would. But how can we assess impact and retain attribution in a distributed publication and review system such as a wiki? Metrics such as journal impact factor and article-level metrics wouldn't directly apply to a community-edited, community-reviewed scientific resource. Attribution and impact assessment are important challenges to any system that aims to replace our journal and manuscript method for disseminating scientific information. While a distributed scientific information system would not easily fit into the context of the current metrics for publication impact that are an intimate part of the funding, hiring, and promotion processes in academia, the consideration of such a system presents an opportunity to explore innovative analyses of the relevance and impact of scientific research. Indeed, rethinking the evaluation of scientists and their work[6] is a pressing need even within the context of the current publication system.

We should be thinking about the benefit of the networked consciousness of online collectivism, not the startling failures of our current publication system to put scientific communication into the hands of the public that enabled it, or even the challenges in preserving integrity and attribution in a commons-based peer production system.[7] We are the generation that grew up with Napster and 4chan, the information generation, the click-on-it-and-it's-mine generation, born into a world of unimaginable technological wealth. Surely we can do better than paywalls, closed peer review, and for-profit publishers. We owe it to everybody: as Emerson put it, "He who has put forth his total strength in fit actions, has the richest return of wisdom."[8]

[1] Ioannidis, John P. A. "Why Most Published Research Findings Are False." *PLoS Medicine* 2.8 (2005): E124.

[2] Stern, Andrew M., Arturo Casadevall, R. Grant Steen, and Ferric C. Fang. "Research: Financial Costs and Personal Consequences of Research Misconduct Resulting in Retracted Publications." *ELife* 3 (2014)

[3] Bush, Vannevar. "As We May Think." *The Atlantic*. Atlantic Media Company, 01 July 1945.

[4] "MediaWiki 1.24." - *MediaWiki*. <http://www.mediawiki.org/wiki/MediaWiki_1.24>.

[5] "WikiScience." - *Meta*. <http://meta.wikimedia.org/wiki/WikiScience>.

[6] "San Francisco Declaration on Research Assessment." American Society for Cell Biology. <http://www.ascb.org/dora/>.

[7] "3. Peer Production and Sharing." <http://cyber.law.harvard.edu/wealth_of_networks/3._Peer_Production_and_Sharing>.

[8] Emerson, Ralph W. "The American Scholar." *The American Scholar*. Web. <http://www.emersoncentral.com/amscholar.htm>.

Current Events in Science Policy

by Nicole Aiello

NIH proposes new rules for publishing clinical trial results

In November the Department of Health and Human Services and the National Institutes of Health released details of a proposal to improve transparency and reporting of federally-funded clinical trials, successful or not. To date, of the 178,000 clinical trials registered to clinicaltrials.gov only 15,000 have posted results. Under the proposed changes, clinical trial sponsors would be required to register with clinicaltrials.gov within 21 days of the first enrollment and provide data on outcomes and adverse events regardless of whether the drug is approved by the FDA. Registration can be delayed for 1-2 years if the drug is not yet approved and is still under development by the manufacturer. The move has been embraced by many doctors and scientists as a way to prevent the duplication of failed trials, a change that would benefit not only the scientific community but also patients. Some pushback may come from the private sector though, as pharmaceutical companies and drug makers typically withhold negative data to protect their financial interests. The proposed rules are open for public comments until February 19th at regulations.gov.

More information can be found:

http://www.nih.gov/news/health/nov2014/od-19.htm

http://www.nih.gov/news/health/nov2014/od-19_summary.htm

http://www.regulations.gov/#!documentDetail;D=NIH-2011-0003-0003

NIH funding to remain flat in 2015

On December 10th House and Senate negotiators came to an agreement on the 2015 appropriations bill which is still under consideration but likely to pass. The $1.01 trillion spending bill includes budgets for numerous scientific agencies including NIH, which saw its funding slashed by 5% last year due to the sequestration. For the 2015 fiscal year NIH budget will experience a $150 million (0.5%) increase which unfortunately is not enough to keep up with inflation and puts the final figure below 2009 funding levels. The bill calls for additional funding in a few specific research areas including Alzheimer's disease, pediatrics and Ebola, and urges NIH to consider disease burden and death rates when deciding how much to invest in an area. The legislation also directs NIH to take steps to reduce the average age at which researchers receive their first R01 grant, which has climbed from 36 in 1980 to 42 today.

More information can be found:

http://news.sciencemag.org/funding/2014/12/within-nih-s-flat-2015-budget-few-favorites

http://officeofbudget.od.nih.gov/pdfs/FY15/Approp%20%20History%20by%20IC%20through%20FY%202013.pdf

Average age of first RO1 grant

1980: 36

2014: 42

US Ebola policy: travel restrictions, containment and treatment centers

With the holidays on the horizon and air travel soon to peak in the United States, Ebola policy may be put to the test. Everyday about 100 people arrive in the US from the three countries most affected by the epidemic: Sierra Leone, Guinea and Liberia. The Centers for Disease Control (CDC) has recommended that anyone who has been near Ebola patients should contact a local public health authority and get a check-up upon arrival; however the CDC has no power to enforce this policy and must rely on the states to carry it out. High risk healthcare workers who have had direct contact with Ebola patients may have to restrict their activities (i.e. avoid public transportation and large social events) or even submit to a 21-day quarantine if protective protocols have been breached. Many states, including New York and New Jersey, have adopted even tighter restrictions requiring all healthcare workers returning from Ebola-stricken areas to undergo a mandatory quarantine. On December 3rd the CDC designated 35 hospitals as Ebola treatment centers, including the Children's Hospital of Philadelphia and the Hospital of the University of Pennsylvania. The 2015 appropriations bill calls for $5.2 billion in emergency spending to combat Ebola, including $238 million for basic research and vaccine development.

More information can be found:

http://www.nytimes.com/2014/10/28/us/new-rules-coming-for-health-care-workers-returning-from-west-africa.html?_r=0

http://www.cnn.com/2014/10/26/health/us-ebola/

http://www.sciencetimes.com/articles/1664/20141203/cdc-designates-35-u-s-hospitals-as-ebola-treatment-centers.htm

Penn Science Policy Group Recent Events

by Michael Allegrezza

Jayatri Das discusses careers in science outreach

In October, PSPG invited Dr. Jayatri Das, Chief Bioscientist at The Franklin Institute, to talk about her career working at the interface of science and society. Her talk was fun, engaging, and informative. She described that the goal of the Franklin Institute is not just to enhance public understanding of science, but rather to promote public *engagement* with science. New discoveries, technologies, and medical treatments are not made in a vacuum. They are integrated in society. And considering that this progress is largely a product of developed nations, which have different values than most of the world's population, it's important to challenge people to think globally. She feels that science museums are a natural place for conversations about the role of science and technology in everyday life. While there are relatively few PhD level scientist jobs at museums, Das explained that they can be very rewarding for scientists interested in outreach and teaching.

Bioethics Discussions

One staple of PSPG has been to generate conversation about ethical issues relating to science and medicine. The fall bioethics series focused on the important topics of biosafety, genetics and criminality, and Ebola. After several reports about biosafety mishaps at research labs, PSPG discussed the research, storage, and weaponization of biological agents. Questions considered included: Should we still be storing smallpox? Is the risk of bioterrorism greater now in the post-genomic era? Should we artificially increase virulence in the lab to be prepared for it possibly occurring in the environment? Another meeting discussed the ethics of studying the possible link between genetics and criminal behavior, and how such research should, or should not be used. In the most recent bioethics discussion, members considered the difficulties of current drug development and vaccination efforts to combat the recent Ebola outbreak.

Inception of National Science Policy Group announced

Over the past year, several members of PSPG have been working with students at other universities to create a network of student led science policy groups. On November 3, a press release by AAAS publicly announced the inception of the National Science Policy Group (NSPG). Led by Samuel Brinton, NSPG brings together nearly 30 student groups and several partner organizations across the nation. Through bi-monthly video conference meetings, the member groups are united under the shared mission of "advocating for science and to promote scientific collaboration, policy group and professional development through sharing of scientific resources."

NSPG updates can be followed on twitter: @NatSciPolGroup

About the Penn Science Policy Group

The **mission** of PSPG is to educate the Penn community on the relationship between science and society. We explore the ethical, legal, and regulatory issues that arise from scientific and technical progress and we advocate for science-informed policymaking, communication of science to the public, and the continued support of research.

PSPG holds regular meetings and hosts speakers to discuss issues and careers in science policy. Our group consists of graduate students and post-doctoral fellows primarily with biomedical research and engineering backgrounds but we are open to the entire graduate and post-graduate community at Penn.

Contact us if you are interested in getting involved with PSPG!

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