



For the Sake of Inquiry and Knowledge — The Inevitability of Open Access

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It's difficult to have a measured conversation about open access — the term widely used to refer to unrestricted online access to articles published in scholarly journals. People who believe

that free and unrestricted access to peer-reviewed journal articles will undermine the viability of scholarly journal publishing disagree sharply with those who believe that only open access can expedite research advances and ensure the availability of that same scholarly literature. Arguments for and against open access tend to focus on implementation details, ignoring the powerful motivations underlying the phenomenon.

The open-access movement cannot be appreciated without an understanding of the complex and interdependent system that produces, evaluates, and distributes scholarly research results. For the past 60 years, five stakeholder

communities have contributed to the system that enables the production of peer-reviewed research literature. In the simplest terms: funding agencies and foundations provide funds to conduct research; universities and other research organizations host the intellects who conduct the research, maintain the research facilities, and educate and train future researchers; authors, with no expectation of monetary compensation, write research articles describing their research findings; publishers accept contributed research papers on condition of copyright transfer, facilitate the editorial process, and manage the production and distribution processes needed for disseminating

the articles; and libraries use institutional funds to purchase, organize, and preserve this publisher output and make it available for current and future research and teaching.

In a system this interdependent, destabilization at any one point perturbs critically important relationships. The advent of the Internet and digital formats was just such a disruption. Initially greeted with enthusiasm on all sides, the transition to digital formats and network distribution channels did not play out as all the stakeholders anticipated or would have liked. As publishers introduced restrictive contractual business models, raised prices (often disproportionately), experimented with digital rights management, and advocated for federal legislation favorable to their own business interests, other stakeholders became concerned about balance in the sys-

tem and began to look for alternatives.

Authors in this system write to have impact, not for royalties. A distribution system that controls and constrains access to articles is anathema to researchers who seek wide influence rather than remuneration. Alternative options, which could fulfill the promise of the Internet as a tool for open and compatible digital publishing, gained early support in discussions. In 2002, the Declaration of the Budapest Open Access Initiative¹ was the first formal call to action, followed the next year by both the Bethesda Statement on Open Access Publishing² and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.³ The central concept of each of these calls to action was simple: peer-reviewed research articles, donated for publication by authors with no expectation of compensation, should be available online, free, and with the smallest possible number of usage restrictions.

A vision of open access to research results is not new. In July 1945, writing in the *Atlantic Monthly*, Vannevar Bush, then director of the U.S. Office of Scientific Research and Development, described just such an environment in his essay “As We May Think.” A staunch advocate of federal support for research in the physical and medical sciences, Bush challenged his fellow scientists and engineers to turn their postwar attention to the task of “making more accessible [the] bewildering store of knowledge.” Bush’s firm belief, which is still shared by academic authors, was that “a record if it is to be useful to science must be continuously extended, it must

be stored, and above all it must be consulted.”

The extent to which access to knowledge is constrained and controlled by publishers’ business models is at the heart of the discontent researchers have for the current journal-publishing system. Peter Suber, a leading advocate of open access, articulates the view from the academy as follows: The “problem is that we donate time, labor, and public money to create new knowledge and then hand control over the results to businesses that believe, correctly or incorrectly, that their revenue and survival depend on limiting access to that knowledge.”⁴ Today, as in 1945, barriers to access to current and past knowledge are viewed by researchers as profoundly at odds with the advancement of knowledge.

Yet producing high-quality peer-reviewed articles has a cost. The fact that faculty members and researchers donate to publishers the ownership of their research articles — as well as their time and effort as reviewers — does not mean that there are no expenses associated with the production of high-quality publications. For all its known flaws, no one wants to destroy peer-reviewed publication. But the nonpublisher stakeholders in the scholarly communication system can no longer support the prices and access constraints desired by traditional publishers.

Discontent with the system extends well beyond authors. Government agencies have good reason to want the research they fund with taxpayer money to be broadly accessible and rapidly built upon; indeed, some would argue that public funders have an ethical imperative to demand open access. Charitable foundations similarly want to share the fruits of

their investments in research and, like governments, need to be able to assess the impact and effectiveness of their funding. Recent policy decisions by Research Councils UK and the European Union⁵ demonstrate a broad and compelling international interest in increasing access to publicly funded research results.

Over the past decade, researchers, research institutions, and funding entities have been experimenting with channels of scholarly communication that serve as alternatives to traditional publishing. Many academic disciplines now utilize large open-access databases (such as arXiv and SSRN, the Social Science Research Network) to share research articles in the pre-peer-review stage. Hundreds of academic institutions and funding agencies now host open repositories of post-peer-reviewed articles that have been authored by grantees or members of their communities. Search engines, which are increasingly popular avenues to scholarly content, facilitate discovery and document use.

These and other experiments and alternatives to traditional publishing are leading the way to a digital, Internet-based, more open publishing system for peer-reviewed journals. The Directory of Open Access Journals (www.doaj.org) lists more than 8000 open-access journals, many of which are highly regarded according to conventional metrics of excellence. Emerging business models include publication fees paid by authors once an article has been accepted for publication, direct support from research grants, and contributions from research institutions willing to contribute financially to publication systems for more openly accessible articles.

Research culture is far from monolithic. Systems that underpin scholarly communication will migrate to open access by fits and starts as discipline-appropriate options emerge. Meanwhile, experiments will be run, start-ups will flourish or perish, and new communication tools will emerge, because, as the Bethesda Open Access Statement puts it, “an old tradition and a new technology have converged to make possible an unprecedented public good. The old tradition is the willingness of scientists and scholars to publish the fruits of their research in scholarly journals without payment, for the sake of inquiry and

knowledge. The new technology is the internet. The public good they make possible is the worldwide electronic distribution of the peer-reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds.”

There is no doubt that the public interests vested in funding agencies, universities, libraries, and authors, together with the power and reach of the Internet, have created a compelling and necessary momentum for open access. It won't be easy, and it won't be inexpensive, but it is only a matter of time.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

From MIT Libraries, Massachusetts Institute of Technology, Cambridge.

1. Budapest Open Access Initiative (<http://www.opensocietyfoundations.org/openaccess/read>).
2. Bethesda Statement on Open Access Publishing (http://dash.harvard.edu/bitstream/handle/1/4725199/suber_bethesda.htm?sequence=1).
3. Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (http://www.zim.mpg.de/openaccess-berlin/berlin_declaration.pdf).
4. Suber P. Open access. Cambridge, MA: MIT Press, 2012.
5. Van Noorden R. Europe joins UK open-access bid. *Nature* 2012;487:285.

DOI: 10.1056/NEJMp1211410

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Open but Not Free — Publishing in the 21st Century

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Since the founding of *Philosophical Transactions* in 1665, journals have been the vehicle of choice for the dissemination of scientific knowledge. Over the years, the number of active, peer-reviewed learned journals has expanded to approximately 28,000, collectively publishing more than 1.8 million articles per year. Most of these journals are accessible by subscription, and before the mid-1990s, they were available only on paper. By the end of the 20th century, most journals had moved their content to online platforms, greatly increasing the accessibility of scientific information.

Online dissemination served as the impetus for the open-access movement and the call for free dissemination of the information contained in journals. Open-access advocates adopted as their slogan the words of author and editor

Stewart Brand (famously of the *Whole Earth Catalog*): “Information wants to be free.” They promoted their cause to legislative bodies by arguing that the taxpayers pay for research, so they shouldn't have to pay again to read the results. But what, exactly, has the taxpayer paid for? And can information dissemination truly be free?

A scholarly journal serves several functions for authors and readers. It serves to register the ideas of the authors, date-stamping them to provide appropriate credit for discoveries. It disseminates the authors' ideas and results to an interested community of scholars. It certifies the validity of articles through peer review. Finally, it archives articles, preserving them for future reference and citation. According to a study conducted by Cambridge Economic Policy Associates, in 2010,

the average journal's cost per article for production in print and electronic formats was approximately £2,500 (\$3,957), once surplus or profit is eliminated from the calculation.¹ For the American Physiological Society, the average cost per article was approximately \$2,635.

Digital technology enhanced access to journal content, but it did not appreciably reduce the cost of publication. Although paper and postage costs were eliminated, they were replaced by costs associated with online submission-and-review systems and hosting platforms. Online journals did not reduce the cost of acquisition for libraries. This fact was especially important, because libraries' acquisition budgets had not increased in parallel with the doubling of the budget of the National Institutes of Health (NIH) between 1997 and 2003. Instead,