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Report and Recommendations From the Scholarly Publishing Roundtable

Scholarly Publishing Roundtable

Association of American Universities

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SCHOLARLY PUBLISHING ROUNDTABLE REPORT

EXECUTIVE SUMMARY

In June 2009, the Committee on Science and Technology of the United States House of Representatives, in coordination with the White House Office of Science and Technology Policy (OSTP), convened a Scholarly Publishing Roundtable to examine the current state of scholarly publishing and develop consensus recommendations for expanding public access to the journal articles arising from research funded by agencies of the United States government. The Committee convened a diverse set of Roundtable participants drawn from the key stakeholders in this debate, and asked them to develop a consensus regarding access to and preservation of the results of federally funded research that addresses the needs of all parties.

The members of the Roundtable included persons drawn from academic administration (three provosts and an association executive) and from academic libraries (three librarians), publishers of scientific journals (two from learned societies, one from an established commercial house offering a range of business models, and one from an innovative and successful open access start-up), and three researchers in the domains of library and information science. Roundtable members were asked to participate as knowledgeable individuals, rather than as representatives of their organizations, and to maintain confidentiality of their deliberations to promote open and candid exchange.

SHARED PRINCIPLES

After recognizing the progress that has already been made in expanding access to scholarly literature, the Roundtable began its work by identifying a set of principles, shared across the full range of member perspectives, which should continue to inhere in scholarly publishing as it evolves. These principles are:

1) Peer review must continue its critical role in maintaining high quality and editorial integrity.

2) Adaptable business models will be necessary to sustain the enterprise in an evolving landscape.

3) Scholarly and scientific publications can and should be more broadly accessible with improved functionality to a wider public and the research community.

4) Sustained archiving and preservation are essential complements to reliable publishing methods.

5) The results of research need to be published and maintained in ways that maximize the possibilities for creative reuse and interoperation among sites that host them.

Roundtable participants' shared commitment to these principles has led to the following consensus recommendations.

RECOMMENDATIONS

The Roundtable's core recommendation is:

Each federal research funding agency should expeditiously but carefully develop and implement an explicit public access policy that brings about free public access to the results of the research that it funds as soon as possible after those results have been published in a peer-reviewed journal.

This public access objective can be accomplished in several ways: Some agencies may choose to develop and manage central databases; others may elect to work with university libraries, one or more publishers, or other external partners to establish centralized or distributed databases of journal articles resulting from the research they fund. The Office of Science and Technology Policy (OSTP) should lead the development and implementation of this multiagency program, which should be authorized in its fundamental properties and goals by regulation or legislation. The program should develop common core properties that will promote interoperability across public access databases. The program also should provide the flexibility necessary to accommodate agency-specific needs and the capacity to evolve over time to accommodate the rapidly changing nature of scholarly publishing. To implement this fundamental objective, the Roundtable proposes the following additional recommendations:

1) **Agencies should work in full and open consultation with all stakeholders, as well as with OSTP, to develop their public access policies.**

2) **Agencies should establish specific embargo periods between publication and public access**. An embargo period of between zero (for open access journals) and twelve months currently reflects such a balance for many science disciplines. For other fields a longer embargo period may be necessary.

3) **Policies should be guided by the need to foster interoperability.** OSTP should work with agencies to facilitate collaboration among them and between agencies and stakeholders to develop robust standards for the structure of full text and metadata, navigation tools, and other applications to achieve interoperability across the literature, taking international standards into account. OSTP should work with agencies that have cyberinfrastructure programs to develop a multiagency program supporting research and development to expand interoperability capability.

4) **Every effort should be made to have the version of record (VoR) as the version to which free access is provided.** If the VoR is not included in a public access database, the article version or reference that is included should contain links back to the VoR on the publisher's site.

5) **Government agencies should extend the reach of their public access policies through voluntary collaborations with nongovernmental stakeholders.** To achieve the full potential of publicly accessible, interoperable databases, the multiagency public access program recommended here should be extended through voluntary collaborations with publishers, universities, and other entities husbanding the results of research, within and beyond the U.S.

6) **Policies should foster innovation in the research and educational use of scholarly publications.**

7) **Government public access policies should address the need to resolve the challenges of long-term digital preservation.**

8) **OSTP should establish a public access advisory committee.** To provide a mechanism for periodic assessment of the rapidly changing scholarly publishing landscape, and to provide a forum for discussion of adjustments to agency public access policies in the context of that changing landscape, OSTP should establish an advisory committee to provide a periodic, independent evaluation of agencies' public access policies and practices.

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The Roundtable's recommendations seek to balance the need for and potential of increased access to scholarly articles with the need to preserve the essential functions of the scholarly publishing enterprise. The Roundtable urges publishers, librarians, universities, and scholars to consider these recommendations as creating an appropriate environment for moving past the decade of too-often acrimonious debate over access issues and providing a basis for collaborating with federal research funding agencies to build an interdependent system of scholarly publishing that expands public access and enhances the broad, intelligent use of the results of federally funded research.

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REPORT AND RECOMMENDATIONS FROM THE SCHOLARLY PUBLISHING ROUNDTABLE

In the past two decades, an explosion of new media and new technologies has heralded the coming "knowledge economy" and has brought access to extraordinary riches of information and novel means of communication to people and communities that have never before had such capabilities. We live in times that seem magical for the powers they give to people even at the very margins of society, people beyond the bounds of economic privilege.[1] Children today carry in their hands or backpacks devices that make everything that ever rode on Dick Tracy's wrist look quaint and obsolete. And the future promises even more remarkable developments leading to a "new age of wonder."[2]

More remarkable still, this explosion in access to information and new technologies has opened the doors to libraries, archives, and resources containing some of the highest and best of human cultural and intellectual products. What once was acquired with effort and pride by a few libraries is now within reach of many people in many places.[3] Cultural Jeremiahs lament the flood of trivia, trash, and lies that pours through our networks, but the best is there for the finding as well, including a rapidly growing, increasingly accessible body of scholarship.

This dramatic expansion in access to digital information also has brought with it new controversies. One particular strain of debate in research, academic, business, and public policy circles over the past decade gives rise to this report. How can we best realize the promise of ubiquitous access to the treasures of intellect when institutions, established practices, and economic necessities inherited from a different time may limit the maximum potential of crosscutting interdisciplinary research achievable today?

This report assesses and makes recommendations in a very specific domain of the debate. Convened by the Committee on Science and Technology of the United States House of Representatives and encouraged by the White House Office of Science and Technology Policy (OSTP), this Roundtable brought together in the summer and fall of 2009 a purposely diverse group of stakeholders in current debates over the publication in journal articles of the results of scientific and scholarly research.[4] We were asked to work together in a search for common ground and to

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[1] Nokia's cellphone anthropologist travels the world looking at how people use and might use networked handhelds: Sara Corbett, "Can the Cellphone Help End Global Poverty?" *New York Times Magazine,* April 13, 2008, http://www.nytimes.com/2008/04/13/magazine/13anthropology-t.html. A report last year from the National Academy of Sciences Board on Agriculture and Natural Resources includes the following sentence: "Farmers [n.b.: subsistence-level smallholders] could receive remotely collected information via cell phones or the Internet and take appropriate action, such as irrigate or fertilize their crops." http://dels.nas.edu/dels/rpt_briefs/ag_technologies_final.pdf).

[2] Freeman Dyson, "When Science and Poetry Were Friends," review of *The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science,"* by Richard Holmes, *New York Review of Books*, August 13, 2009, http://www,nybooks.com/articles/22955.

[3] It is already a decade since the philosopher Anthony Appiah was quoted as saying that the library he never went to was one of the most important places in his life — because he could reach it from so many places.

[4] Appendix A: Scholarly Roundtable membership list.

develop recommendations that would materially advance public access to the journal articles arising from research funded by agencies of the United States government.[5] We believe we have accomplished our mission.

The members of the Roundtable included persons drawn from academic administration (three provosts and an association executive) and from academic libraries (three librarians), publishers of scientific journals (two from learned societies, one from an established commercial house offering a range of business models, and one from an innovative and successful open access start-up), and three researchers in the domains of library and information science. There were overlaps as well: One of the librarians is a professor of economics and former provost, another has broad experience in the policy sector and with international organizations, one of the provosts is also responsible for the publications of a humanities learned society, and another of the provosts has served as an editor for journals managed by both commercial and nonprofit publishers. Most members are or have spent a good portion of their careers actively involved in research and scholarship. Almost every participant, in other words, brought more than one perspective or sympathy to the table. We chose to be bound by the Chatham House Rule to maintain the confidentiality of our conversations, so that we could challenge each other to act beyond our immediate roles and home organizations in a series of frank, lively, and illuminating conversations that were backed by gathering of data and reading of some of the extensive literature on the subjects we discussed.[6] We learned about intersecting efforts that are under way in this country and others,[7] and we were struck by the rich interdependence and international scope of the research and scholarly publishing endeavor. Our conversations were thoughtful and amicable, marked by clear and firm statements, sharp questions, and a sense of shared learning.

The members of the Roundtable feel privileged to have had this opportunity, and, in this special atmosphere, we believe that as a community we are further along than we thought. We also believe there is further still we can go together, within an expanding international community, in ways that will make a real difference for all authors and users while ensuring the continued excellence and reliability of the scholarly publication system in which we all play interdependent roles.

At the end of this process, we judge that immense progress has been made in building an information universe richer and more powerful than anything we have known before. Where there is controversy over practices surrounding access, we judge that the research community faces not a battle to be won but a problem to be solved — or, even better perhaps, an opportunity to be seized — cooperatively and collegially.

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[5]See the House Science and Technology Committee charge, http://www.aau.edu/policy/scholarly.aspx?id=6894.

[6]Appendix B: Bibliography.

[7]See, for example, the Chicago Collaborative, http://www.chicago-collaborative.org/, and Publishing and the Ecology of European Research (PEER), http://www.stm-assoc.org/public_affairs_peer.php.

BUILDING ON SUCCESS

Ten years ago, it was already a source of surprise to at least one of the founding visionaries of the electronic scholarly journal community[8] that electronic access to digitized representations of print journals had given rise to explosive growth in usage of those journals. JSTOR, the project launched by that visionary — Mellon Foundation President William Bowen — reported a few years later that, though it charged a subscription fee for access to the materials it hosts, when it opened those materials to Google indexing — meaning many new readers could gain snapshot access to selected materials — JSTOR had to purchase new servers to handle the load.[9] Those anecdotes are a reminder that access is multidimensional, that a scientist (or scholar or student) who has had access on a library's shelves to bound volumes of a journal is genuinely liberated when all the back and current issues of that journal are within reach of computers connected to a global network.

Scholarly Publishing: A glimpse at the enterprise

The immense scale of the global scholarly publishing enterprise is not captured by a single source. Ulrich's[a], the most comprehensive of journal databases, reported in early 2009 that nearly 25,400 peer-reviewed journals were produced from more than 2,000 publishers. A recent study involving a similar dataset concluded that mainstream publishers of scientific, technical, and medical journals publish more than 1.5 million articles per year[b]. The total worldwide revenues from scholarly journal publishing were estimated from the above datasets to be $8.0 billion in 2008[c,d], with approximately $3 billion attributed to the U.S. market. This enterprise directly employs approximately 110,000 people worldwide and 30,000 in the US. Online availability of scholarly journals has grown steadily since the first journals appeared online nearly a decade ago. From a survey of scholarly publishers responding to a 2008 request by the Association of Learned and Professional Society Publishers, respondents indicated that 96% of all scientific articles and 87% of all arts and humanities articles were available electronically.[c] Subscription payments by individual libraries and library consortia represent the dominant business model, accounting for more than 90% of the current titles, with author- or sponsor-paid models accounting for most of the remainder.[d,e]

a.) Ulrich's Periodicals Directory, 16 March 2009, http://www.ulrichsweb.com/ulrichsweb.

b.) Bjork, B., A. Roos, and M. Lauri, "Scientific Journal Publishing: Yearly Volume and Open access Availability," *Information Research*, **14** (1) paper 391 (2009). http://InformationR.net/ir/14-1/paper391.html

c.) Cox, J. and L. Cox, (2008) *Scholarly Publishing Practice: Academic Journals Publisher's Policies and Practices in Online Publishing*, 3rd ed., ALPSP (2008), http://www.alpsp.org/ngen_public/article.asp?id=200&did=47&aid=24781&st=&oaid=-1

d.) Outsell, "An Open Access Primer-Market Size and Trends" (2009), http://www.outsellinc.com/contact_us/open_access_primer_2009

e.) Ware, Mark and Michael Mabe, *The STM Report: An Overview of Scientific and Scholarly Journals Publishing,* September 2009, http://www.stm-assoc.org/news.php?id= 255&PHPSESSID= 3c5575d0663c0e04a4600d7f04afe91f

In the past fifteen years, we have experienced a revolution in what is accessible through these networks. Digitization of backfiles and production of new issues in both expanded digital formats and print form have

[8] William G. Bowen, "Information Technology and Independent Scholarship: The Efficiencies of Collaboration," in *America's Research Universities — Quality, Innovation, Partnership: Proceedings from the Centennial Meeting of the Association of American Universities* (April 17, 2000).

[9] Kevin Guthrie, President, JSTOR; personal communication (2009) with James O'Donnell, Provost, Georgetown University.

essentially been completed for much of the scientific and scholarly journal literature. To be sure, there are disciplinary differences,[10] but certainly in many fields and many parts of the world digital access is not only common but virtually the only way in which researchers discover and use research materials. Subscription journals have been available in both electronic and print versions and now are increasingly available for electronic-only subscription and use at prices that are often lower than the prices for print. Despite real concerns about the rising costs of journal subscriptions, researchers and their institutions have found ways to pay and to integrate these more accessible (and more abundant[11]) materials into their working lives.

In today's major research institutions, access to information is characterized by overload rather than scarcity, while the unit cost for accessing information continues to fall. Studies indicate that for many scholars, online access to journal articles has improved substantially in recent years.[12] The many factors, however, that increase the total cost of access to needed information are challenging the strained budgets of universities and their libraries, while access to the literature by the broader public remains limited in most circumstances.

Thus, much more needs to be done. The flood of newly available information highlights the barriers that still stand. A subscription model for access to a journal or database means that institutional users, and particularly users at research-intensive institutions that have more funding for resources including subscription journals, have a marked advantage over independent scholars, the general public, and many readers and researchers in underdeveloped and developing nations. Moreover, a great many self-employed scientists, independent medical practitioners, and scientists and engineers who work for small firms in the U.S. have at best limited access to library collections. Typically, they have relied on personal subscriptions, while in 2005 university scientists read on average at least one article from 33 different sources.[13] Quantifying the access that *isn't* happening is impossible, and we are in the paradoxical state in which more users have vastly more access to more information than ever before in history, while fences and frictions persist for at least some users and groups.

A growing number of all types of journal publishers choose to make their articles freely available to researchers, students, and others in 100 or more developing countries, using various metrics to calculate national income and technologies as access identifiers. Some well-known programs include the UN's trio (HINARI, AGORA, OARE), HighWire's "Developing Economies" program, and JSTOR's "Developing Nations" initiative. Other well known programs include those of eIFL, INASP, and TEEAL. For descriptions of these and more, see: http://www.library.yale.edu/~llicense/develop.shtml.

[10] Carol Tenopir and Donald W. King, *Communication Patterns of Engineers* (Hoboken, NJ: Wiley-IEEE Press , 2004).

[11] One feature of the present economy that is hard to feel viscerally is the way in which the so-called "big deal" subscription model that has flourished since about 1995 has given even the most privileged institutions access to many journals and resources they never saw before. Although this mechanism has drawn criticism as resulting in the acquisition of journals the subscriber may not want, it can also have salubrious effects to both journals and subscribers. One humanities journal known to our group was surprised recently to discover that though its parent society has 3000 members, its digital reach through Project Muse puts it in the libraries of more than 2000 institutions, when it used to number institutional subscriptions in the low hundreds.

[12] Philip Davis, "Studies on Access: A Review," December 2009, http://arxiv.org/abs/0912.3953.

[13] Carol Tenopir, Donald W. King, Shen Edwards, and Lei Wu, "Electronic Journals and Changes in Scholarly Article Seeking and Reading Patterns," *Aslib Proceedings: New Information Perspectives*, **61** (1) February 2009: 5-32, DOI: 10.1108/00012530910932267.

The system of scholarly publishing has served the scholarly community well in many respects since the print journal era began in the mid-seventeenth century. The growing strains in this system, coupled with the rapidly unfolding opportunities enabled by new technologies, encourage us to view the digital era as one in which the scholarly literature can and should operate ever more as both a lubricant for increasing the pace and scope of discovery and an adhesive that can help draw together disparate spheres of knowledge while expanding public access to the full corpus of knowledge and discovery.

Although it is but a subset of the published scholarly literature, one particular domain of information has been at the center of the Roundtable's discussions: Resources drawn from tax dollars contributed by an entire population have been and are being invested, through a process of federal agency grants, in research for discovery of new knowledge. Completing the circle of accountability means making the results of such research broadly available to those who can use the new knowledge transformatively, to readers from education and the general public who seek knowledge for many purposes – not least the urgent curiosity of those with a personal stake in medical discoveries — and to officials and other analysts who might wish to track and assess the effectiveness of the investment of public resources. Although federal employees engaged in research produce work that is in the public domain from the outset,[14] employees of other public and private entities that receive federal support retain by statute full copyright ownership of their created works — whether by the individuals or by the employers as "works for hire."[15] In a well-developed and established publishing system in which the authors place work for publication with publishers, who in turn organize peer review and distribute the value-added, edited, and organized content to subscribers, access to the best scholarship and science remains mediated through pricing mechanisms and business models whose continuation in their current form has come into question and which are destined to evolve rapidly.

Publishers make journal content available online (and, decreasingly, distribute it in print), protect the integrity of such content, and identify their journal brands through intellectual property rights (IPR) such as copyright and trademarks. At the same time, scholarly publishers have supported certain informal communication systems, such as the sharing with colleagues of drafts or posting of pre-prints, that co-exist with the formal. While they may technically infringe such rights, these informal systems facilitate scholarship in the communities the publishers serve and do not pose significant risk to journal business models. Scholarly publishers often pragmatically balance formal IPR with the research needs of the communities served by their journals.

Journal articles exist in several stages: the author's original or "preprint," which is an unrefereed prepublication document; the accepted manuscript; the version accepted for publication; the final published version or "version of record"; and later corrected or enhanced versions of record maintained by the publisher. A great deal of work has gone into defining and identifying the various versions of an author's article because of differences that can exist between the various versions; see *Journal Article Versions (JAV): Recommendations of the NISO/ALPSP JAV Technical Working Group,* NISO-RP-8-2008, published by the National Information Standards Organization.

Open access (OA) publishers do not depend on subscription

[14] Copyright Act, U.S. Code 17 (1976), § 105, Subject matter of copyright: United States Government works. Articles published under those circumstances are so identified by publishers and are not subject to individual copyright ownership. Publishers, however, are under no obligation to make those works generally available, so in practical terms, they may be subject to the same access limitations as works that are covered by copyright.

[15] Copyright Act, U.S. Code 17 (1976), § 201, Ownership of copyright.

revenue because their costs are recovered up front through other revenue streams, such as publication fees, advertising revenue, sponsorships, institutional subsidies, grants, or some combination of these.[16] With revenue secured beforehand, these business models permit free access to and liberal reuse of published content. Such publishers may choose not to obtain rights or to retain only those rights necessary to assure the integrity and preservation of content. Over the past several years, an increasing number of scholarly journals are migrating from the traditional subscription model to a hybrid model in which immediate (i.e., open) or early access to particular articles is paid for by research funders or by authors or their institutions. Further, recently developed legal devices such as Creative Commons licenses[17] provide a means for exercising certain rights but not others. Such licenses often provide specified re-use rights predicated on a requirement that newly created works (or technical improvements) resulting from the permitted re-use are also made available to the community.

One important venture in online access developed outside the publishing community is beginning to have enough of a track record to allow assessment of its strengths and weaknesses. PubMed Central (PMC) was initially developed by the National Library of Medicine to serve as a permanent archive of the published biomedical literature. Under the terms of the National Institutes of Health (NIH) Public Access Policy, in effect since April 2008, principal investigators are required to ensure deposit of their accepted manuscripts that result from NIH-funded research.

We have been impressed by many aspects of PMC's internal interoperability[18] and see much good that has resulted from the NIH's venture, including the broad adoption of PMC's document type definition (DTD) as a standard architecture for online journal articles in the biomedical sciences. As an "observatory," PMC and its utilization in support of the NIH public access policy have encouraged Roundtable members to think deeply about how best to learn from the PMC experience — about ways to incorporate incentives and structures necessary to develop an even more robust system that ultimately integrates research results supported by all major federal funding agencies in conjunction with the worldwide community of funders, researchers, and publishers.

Nonetheless, some participants in the multifaceted scholarly publishing system harbor serious reservations about the appropriateness of a government agency assuming a role that in their view is being or might be more suitably carried out by the private sector or through collaborative stakeholder projects. For example, some of the services undertaken by PMC may be considered to be duplicative of activities being carried out elsewhere in the system. In the recommendations that we offer below, we have proposed ways to rationalize the appropriate roles of the government and nongovernmental participants in the system and ways that government agencies and nongovernmental stakeholders can collaborate as equal partners to their mutual benefit in strengthening the scholarly publishing system and expanding public access to its outputs.

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[16] Raym Crow, *Income Models for Supporting Open Access*, (Washington, DC: Scholarly Publishing and Academic Resources Coalition, 2009), http://www.arl.org/sparc/publisher/incomemodels/imguide.shtml.

[17] "Creative Commons is a nonprofit corporation . . . that provides free licenses and other legal tools to mark creative work with the freedom the creator wants it to carry, so others can share, remix, use commercially, or any combination thereof," Creative Commons Website, http://creativecommons.org/about.

[18] Interoperability refers to the capacity of systems to work together, to interconnect, and to use the components of the interconnected systems. Interoperability applied to repositories of scholarly journal articles such as PubMed Central refers to the capacity to search, identify, analyze, and recombine disparate components of the text and data held within and across such repositories.

Over the past 15 years, many publishers have made the decision to move toward increasingly open structures and archives.[19] Our group found broad consensus about continuing to eliminate, as much as possible, access barriers that still stand. We recognize that to do so will challenge a complex and interdependent system that depends on the deep commitment of many stakeholders but that operates optimally when the major players — governments, research communities, libraries, and publishers — work together cooperatively.[20] The current system, moreover, runs across many sectors of many economies; hence, it is essential to consider the behavior and principles of the players in a large, loosely-coupled, and — most importantly for the progress of science — international system. The aspiration, which borders on an obligation, is to work collaboratively to continue to build a robust, evolving, interdependent system of partnerships in which all parties — including governments — take appropriate roles.

We also recognize the importance of attending to issues of scale over time as well as space. Much has changed in the environment of research publication in the past two decades, and much more will change in years to come. We judge that it is imprudent to try to look beyond approximately a five-year time horizon — because the pace of technological change makes longer predictions unreliable for policy — or to define expectations in ways that do not allow flexible response as the realities of electronic publication continue to change rapidly. The most recent news from one major journal publisher, for example, suggests that it will shortly begin adding features to its published articles that will make the difference between a flat file of the plain text and the published article itself, with multimedia supplements and the like, greater than ever.[21] And a recent analysis of the use of scientific literature in the online environment indicates that the increasing use of indexing, retrieval, and navigational tools and the emergence of interoperable ontologies is set to transform the ways scientists engage the online literature and profoundly affect the future of scientific publishing.[22] In that spirit, our group aspires to preserve the essential components of scholarly publishing that assure its quality and integrity as new knowledge makes its way from the scholar's office or laboratory into the published record, while seeking to expand access to and use of knowledge as energetically as possible.

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[19] Sally Morris, (2009), *Journal Authors' Rights: Perception and Reality* (London: Publishing Research Consortium, 2009), http://www.publishingresearch.net/documents/JournalAuthorsRights.pdf.

[20] Stuart M. Schieber, S. M. 2009. "Equity for Open Access Journal Publishing," *PLoS Biol* **7**, e1000165, http://dx.doi.org/10.1271/journal.pbio.1000165.

[21] Marshall Kirkpatrick, "Elsevier's Prototype: Is This The Scientific Article of the Future?" *New York Times* [Online], 24 July 2009; http://www.nytimes.com/external/readwriteweb/2009/07/24/24readwriteweb-elseviers-prototype-is-this-the-scientific-61697.html. Also, Brian Whitworth and Rob Friedman, Rob, "Reinventing Academic Publishing Online, Part I: Rigor, Relevance and Practice" *First Monday* [Online] **4**(8), (26 July 2009); and Michael Nielsen, "Is Scientific Publishing About to Be Disrupted? Michael Nielsen Blog [Online], 29 June 2009, http://michaelnielsen.org/blog/is-scientific-publishing-about-to-be-disrupted/.

[22] Allen H. Renear et. al., "Strategic Reading, Ontologies, and the Future of Scientific Publishing," Science **325**, 828 (2009); DOI: 10.1126/science. 1157784.

PRINCIPLES TO GUIDE THE CONVERSATION

Our initial charge was focused on access to federally funded research literature. We soon realized, however, that access cannot be considered apart from other key issues. As important as access is, policies that will ensure the greatest public good over the long term must carefully balance several essential elements. Thus, we began our work by identifying shared principles. We quickly found that across the full range of perspectives brought to the roundtable, we could agree on key points as a basis for our discussions. The principles we espouse are these.

1) Peer review must continue its critical role in maintaining high quality and editorial integrity.

We affirm that the system of scholarly publishing should be strongly marked by a sustained, transparent, and recognized commitment to identifying, improving, and distributing work of the highest quality and value. The traditional mechanisms of peer review, supplemented by expert editorial effort, have played a critical role in maintaining the quality of scholarly publishing; those mechanisms represent at the same time the commitment of millions of researchers who contribute their time and talent to participate in peer review and serve as editors. We cannot be certain that today's mechanisms will be sustained in a form all will recognize, but we stand by our insistence that users must be guided by quality markers that differentiate the best work and that give readers confidence in the data and arguments they encounter.

2) Adaptable business models will be necessary to sustain the enterprise in an evolving landscape.

The enterprise that brings together contributions of many researchers with the editors, technologists, and publishers that can sustain their work must be thought of as "business," whether the journal is small and thinly staffed or involves a large editorial effort. Such enterprises have costs, and those costs must be covered by appropriate sources of funds. In traditional publishing of scholarly journals, the need to print and distribute a physical artifact has been the main basis for gaining revenue, usually from subscription sales. When, in the digital environment, the marginal costs of distribution drop toward zero, new possibilities for access and use open, even as many first-copy, nondistribution costs remain and new costs emerge for maintaining reliable, platform-independent, online systems. However, there is still significant demand for print journals, which means that many publishers cannot yet take advantage of the reduced cost of discontinuing print production and distribution.

> The Public Library of Science (PLoS) was launched in 2002 as a bold new experiment in high-quality open access publishing (http://www.plos.org/downloads/progress_report.pdf). PLoS expects to reach the break-even point in annual operating budget in 2010 with a publishing portfolio comprising three classes of journal of differing costs and selectivity. The overall operation covers all costs up front through publication fees, and thereby PLoS can provide access to the final peer-reviewed publications to scholars and the public for no cost and with no restrictions on the reuse of the content.

As noted previously, one emerging OA publishing model obtains the revenue to meet these costs in advance through charging a publication fee or securing the requisite revenues from institutional subsidies, advertising revenues, or other association revenues. In addition, the emerging hybrid model of subscription-based journals provides for immediate or early access to individual articles when publications fees are paid by sponsors. These promising new approaches have been implemented by both commercial and nonprofit publishers, although it is not yet clear how broadly they will be adopted.

Finding business models that sustain the enterprise and thus underpin the quality and reliability of the scholarly publishing endeavor is an urgent task, and although the percentage of peer-reviewed journals that have made a change in model is appreciable, it is still small.[23] Therefore, we do not judge that any existing digital business model has demonstrated its viability to the satisfaction of all, and so we caution against a premature anointing of any single approach.

But the business realities of evolving models must be attended to, precisely because they assure quality and reliability. The future we envision includes, first, diverse and flexible market-driven approaches to publication and its cost recovery, and new enterprises — both not-for-profit and for-profit — built on top of a set of publicly accessible elements and findings that increasingly can be searched, analyzed, and recombined across disciplines. Second, it includes further improved access to and use of scholarly works – not just those derived from U.S. government-funded research but the full corpus of international work.

3) Scholarly and scientific publications can and should be more broadly accessible with improved functionality to a wider public and the research community.

We strongly encourage efforts to further expand access to the scholarly record and improve its functionality, and we affirm that substantial additional progress in achieving these goals for traditional and nontraditional audiences is both feasible and desirable. To the fullest extent possible, access should be to the definitive version of journal articles — the version of record (VoR) produced and stewarded by the publisher — both to make that version available to support future scholarship and to avoid the circulation of differing versions of scholarly publications, which carries with it the risk that different readers will think they are seeing the same article but in fact may be getting different information, sometimes marred by error.

4) Sustained archiving and preservation are the essential complements to reliable publishing methods.

What is published must remain available in perpetuity. A reliable record is itself a guarantor of quality and a resource for continued investigation. Yet information in every medium is notoriously fragile and at risk. The disappearance of the moonwalk videotapes of 1969[24] can be taken as a symbol of the challenges. Digital

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[23] Ware, Mark and Michael Mabe, *The STM Report : An Overview of Scientific and Scholarly Journals Publishing.* September 2009, http://www.stm-assoc.org/news.php?id=255&PHPSESSID=3c5575d0663c0e04a4600d7f04afe91f.

[24] Thomson Reuters, http://www.reuters.com/article/newsOne/idUSTRE56F5MK20090716.

information is only the latest embodiment of that fragility. Merely placing publications in a well-cared-for physical repository is inadequate for making digital information accessible to a reader months or years, let alone generations, later. There has been much progress in the past decade in developing standards and systems for assuring readers of the reliable durability of digital publications, but no firm consensus regarding standards or systems has emerged. As a community, we all need to attend to these issues and to make sure that whatever mechanisms are created for expanding access include ensuring future access as a critical indicator of their success.

5) The products of research need to be published and maintained in ways that maximize the possibilities for creative reuse and interoperation among sites that host them.

Digital information is never frozen or immutable. By comparison to the world of print publication, digital dissemination of research results lends itself to many kinds of creative adaptation and reuse. Data mining, text mining, intelligent linking between articles from different journals and host sites, cross-disciplinary connections, and linking to resources containing other kinds of data objects or information are all possible in many forms and can lead to transformative use of existing research results. Prediction of specific future needs is impossible, but robust standards for the preparation, dissemination, and preservation of work have critical roles to play, as does work on the management of IPR to establish workable boundaries between the freest possible use of new knowledge for noncommercial research and education purposes and opportunities for rights holders expressly to permit commercial exploitation. While we emphasize the need for free and wide use, we also encourage the maintenance of a robust competitive environment in which the entrepreneurial will find ways to offer services in support of better utilization. Such entrepreneurship can support the evolution of business models in important, positive directions. The very mutability of digital information that we believe should be exploited in creative adaptation and reuse also underscores the need to track and preserve the various versions of scholarly works, particularly the VoR stewarded by the publisher, which should form the basis for future recombinations and reuses.

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We made one more observation on matters of principle. Our first four points are traditional and may seem obvious. Although they have new dimensions and implications in the world of electronic publishing, they come easily to mind and represent current high principles and commitments. Our growing awareness of the possibilities of creative interoperation and reuse surprised us in the common discovery that we all feel strongly about a future environment as one in which scholarly and scientific information, in order to be accessible in a meaningful way, must allow readers the greatest freedom, consistent with a thoughtful application of IPR by rights holders, to make what they judge to be the most productive use of it. This discovered common commitment has some important consequences, as described below.

RECOMMENDATIONS

Each federal research funding agency should expeditiously but carefully develop and implement an explicit public access policy that brings about free public access to the results of the research that it funds as soon as possible after those results have been published in a peer-reviewed journal.

There is no single way to accomplish this public access objective. Some agencies may choose to develop and manage central databases of journal articles resulting from the research they fund; others may elect to work with external partners—for example, university libraries or one or more publishers—to establish centralized or distributed databases of research results. However accomplished, the functional outcomes should be the same: the provision of free and ready access to the results of agency-funded research as soon as possible. To facilitate public access and, in particular, to support scholarship, agency databases should be able to talk to each other. Therefore, each agency's policies should include common core properties that promote access to and interoperability among the articles in all public access databases. Beyond these common properties, the agencies should have the flexibility to manage and modify their policies over time in response to evolving circumstances. Agencies should fully engage researchers, institutions, and publishers working in fields that coincide with the agencies' missions, both in establishing initial public access policies and in modifying those policies as appropriate over time.

We believe that the Office of Science and Technology Policy (OSTP) is the appropriate federal agency to lead the development and implementation of a coordinated multiagency public access program that defines common properties to be shared by all research funding agencies in a coherent framework that also is flexible enough to accommodate agency-specific needs. The authorization for such a multiagency program will need to be established by the regulatory authority of the Office of Management and Budget or by some combination of legislation and regulation. We emphasize that whatever mechanism is used to establish the program will need to provide sufficient flexibility to accommodate initial agency-specific differences and the capacity to evolve over time in response to rapid and unforeseeable changes in scholarly publishing and the provision of public access to its output. Among the key properties of a public access policy that should be addressed are the following:

1) ***Agencies should work in full and open consultation with all stakeholders, and with OSTP, to develop their public access policies***.

It is critical for agencies to engage all stakeholders in developing their public access policies so that the essential principles of scholarly publishing specified earlier in this paper — peer review, adaptable business models, expanded public access, archiving and preservation, interoperability and reuse — are maintained as the various sectors of this publishing system adapt to and implement changes. The process by which agencies develop and implement their policies must be one in which all parties work tirelessly to build and sustain trust in each other, a trust that must be both earned and returned. We are convinced, in part by our own experience, that the best progress will be made when all parties are open, frank, and mutually respectful, building a conversation that lasts rather than engaging in a debate that is resolved unsatisfactorily.

2) ***Agencies should establish specific embargo periods between publication and public access.***

Federal research funding agencies should establish a period of embargo between first publication of a funded research article and the time when that article is made freely available to the public. The length of an embargo period should be as short as possible to reflect an appropriate balance between a commitment to rapid public access and the need to allow orderly evolution of business practices among established journals. We believe an embargo period of between zero (for OA journals) and twelve months currently reflects such a balance for many science disciplines. For other fields longer embargo periods may be necessary. The need for longer embargo periods is particularly likely in humanities and social science fields. Current embargos, whether established by publishers or federal policy, vary within and between fields and have changed over time according to changing circumstances.[25]

The vast majority of scientific journals remain subscription-based, while new journal business models emerge on a regular basis. The major challenge we see for the scientific community is to push as hard as possible for the broadest and least obstructed access to the results of research while respecting the need to maintain reliable publishing channels in a time of rapid change.[26]

Again, we judge that the federal agencies, in consultation with their researchers and other stakeholders, are in the best position to think about what will work in their communities, discipline by discipline, and to provide appropriate incentives to spur innovation and change that can improve access through reduced embargo periods and other means. What these incentives might be is also best determined by each agency with appropriate input from the stakeholders. For example, agencies might fund exploratory pilot projects aimed at fostering the development of novel, self-sustaining information products in much the same way, perhaps, that the development of the Public Library of Science was supported by the Gordon and Betty Moore Foundation.[27] We believe that over time, creativity and insight can produce lower-cost, higher-leverage techniques to help publishers and authors move toward more generous permissions to access.

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[25] The six-month embargo period proposed by NIH for its public access policy was lengthened to twelve months following discussions with publishers, many of whom had already established policies for providing free access to their journal articles twelve months after they were published, because they determined that such a time frame was consistent with their business goals. Certain publishers have increased or decreased their embargo periods based on their judgments of the impact of embargos on their publishing operations and the interests of their subscribers. The *Proceedings of the National Academy of Sciences* increased its embargo period from three to six months, while the *Molecular Biology of the Cell* reduced its embargo from twelve to two months, and the American Astronomical Society has reduced its embargo from five to three to two years. A recently released study of journal publishing in the humanities and social sciences (National Humanities Alliance; http://www.nhalliance.org/bm~doc/hssreport.pdf) concludes that, given the comparatively long life of articles in these fields, the imposition of embargo periods that are being adopted for biomedical journals could threaten the sustainability of humanities and social science journals.

[26] If either federal agencies or universities or both were to categorically underwrite the collective costs of author charges, subsequent budget pressures could result in setting limits on individual author-charge coverage, which could lead to unintended rationing of at least one aspect of research support.

[27] Public Library of Science (PLoS), http://www.plos.org/about/index.html.

3) Policies should be guided by the need to foster interoperability.

Ease of access is an essential step, but not the only necessary one, to maximize the use and usefulness of the results of federally funded research. The establishment and promulgation of robust standards for the structure of full text and metadata, navigation tools, and other applications to achieve interoperability across the literature will substantially enhance the impact of the scholarly literature and ignite the generation of new knowledge. The OSTP should work with agencies to facilitate collaboration among them and with stakeholders in developing such standards and in ensuring that the standards are broadly applied, taking into account existing nongovernmental programs and initiatives as well as relevant international standards. The long-term goal should be interoperability of full text across distributed databases of journal articles. Decentralization is critical to achieving this goal, especially with respect to interdisciplinary research. Centralized databases currently have greater capacities for robust internal interoperability. However we anticipate that similar results can be achieved across distributed databases if the development of interoperability capacity is properly supported and implemented. Currently, NIH's public access policy is building a freely accessible database of the results of NIH-funded research within its PubMed Central portal, and the agency is developing the capacity to support rich interoperability among its holdings to the considerable benefit of scholars and scholarship. However, the standards and tools adopted by NIH, which effectively support interoperability within PubMed Central, do not yet support comparable interoperability with external databases, which are growing in number and size. As noted above (pg. 6), PubMed Central's document type definition (DTD) is being broadly adopted as a standard architecture for journal articles. With increased standardization of formats and processes, interoperability across databases will approach that achievable within databases.

In developing their public access policies and procedures, agencies should keep a weather eye on international cooperation, building standards and distributed systems that are global in scope and go far beyond the work funded by federal research dollars in the U.S. A successful and optimized scientific publishing system will incorporate effective incentives to implement and expand interoperability and reuse across international distributed databases; a goal of that global publishing system should be the integration of the entire corpus of scholarly literature.

The National Science Foundation (NSF), Department of Energy and other agencies provide important funding for the development of interoperability capacities through their cyberinfrastructure programs. We encourage the OSTP to work with these agencies to develop a coordinated multiagency program supporting research and development to expand interoperability capacity and to develop and promote additional interoperability practices and standards.

Effective IPR management will be a critical aspect of the development and implementation of fully interoperable distributed systems. All parties have the right to expect that such systems will secure the identity and integrity of the work made accessible under these policies. IPR management should support the widest possible reuse while recognizing its role in protecting the integrity of journal content. We expect no absolutely clear-cut, hard and fast line to separate the freely available and the permitted commercialization, but we expect that material once made available should not then be taken out of public access entirely by proprietary reuse; the accessible version of the material should remain open to all, whatever may be done for a fee by those who have unique uses and capabilities to offer.

Scholarly publishers should—and generally do—calibrate the level of IPR they obtain, balancing the needs required for their journal operations and the needs of scholars and researchers for early access and reuse and repurposing. The best practices in publisher licenses provide for a wide scope of scholarly uses and recognize the needs of authors to use their own papers in their research and teaching endeavors. We recommend continued engagement among the relevant stakeholders to develop and expand the implementation of best practices, such as the use of Creative Commons or other standard licenses.

4) *Every effort should be made to have the version of record as the version to which free access is provided.*

The VoR – the final published article, stewarded by the publisher — is the definitive version of a journal article. Significant differences may exist between the VoR and the final accepted manuscript, and indications are that given the option, researchers prefer to use the VoR over preceding versions[28]. To the extent that public access systems provide the VoR, the problem of conflicting versions of articles is greatly reduced. Moreover, the VoR includes any later updates to that article maintained by the publisher, so providing access to the VoR preserves the integrity of scholarship by ensuring that post-publication corrections to or modifications of the original article are also publicly available.

We recognize the constraints on government agencies to require the submission by funded researchers of the final published version of their articles. Thus, NIH requires the submission of final accepted manuscripts and encourages but does

CrossRef: A model organization for promoting interoperability

At the beginning of 2000, a collaboration of scholarly publishers founded the nonprofit, independent organization, Publishers International Linking Association, Inc. (PILA), which operates CrossRef on behalf of the academic community. By 2009 the CrossRef organization included more than 2600 participating publishers, 700 member publishers and 1500 library affiliate members (see http://www.crossref.org). CrossRef's initial product was the development of a journal-reference linking service that functions as a digital switchboard for access to bibliographic data on more than 33 million journal articles. The CrossRef database contains essential article metadata, supplied by participating publishers, that allows researchers to search and link articles through a digital code identifying every unique article, the CrossRef Digital Object Identifier (DOI) name. The end result is an efficient, scalable linking system through which a researcher can click on a reference citation in a journal and access the cited article.

CrossMark—a new service of CrossRef to certify the version of record

As various versions of a scholarly article appear on the web as an author's article moves from a submitted manuscript, to the peer reviewed version accepted by the publisher, to the version of record maintained by the publisher, the integrity of the article's content can be compromised by access to these multiple versions. An added complication is that the VoR is not fixed in time. A scholarly publication can be enhanced, amended, corrected, updated, withdrawn, and even retracted. The publisher, in its role of certifying the scholarly literature, has a duty to keep the scholarly record sound and free from fraudulent or incorrect data. Publishers do this by stewardship of the VoR—periodically updating the status of the publication at the request of authors, editors, and vigilant reviewers. Unfortunately, researchers have no standard way to determine whether they are looking at the stewarded version of a publication maintained by the publisher. Responding to this problem, CrossRef will be introducing a new service in 2010 (CrossMark, see http://www.crossref.org/crossmark.html) that will allow readers to easily determine whether they are looking at the publisher-maintained, stewarded version of a journal article. The stewarded version of an article, whether on the publisher's site or a secondary site per publisher—host site agreements, will be noted by an electronic watermark indicative of the required stewardship standards for maintenance of the VoR.

[28] Edwin A. Henneken et al.,"E-prints and Journal Articles in Astronomy: A Productive Co-existence,". *Learned Publishing* **20**, 16 (2007), http://dx.doi.org/10.1087/095315107779490661.

not require the submission of final published articles. Nonetheless, many publishers voluntarily submit the final published article (or allow authors to do so), and thereby make the VoR available for public access and establish the conditions for maintenance of the VoR over time through post-publication corrections or modifications. If the VoR is not included in a government public access database, the article version or reference that is included should contain a link back to the VoR on the publisher's website.

The integrity of scholarship can be jeopardized by having multiple, possibly conflicting versions of the same article in circulation, and government public access policies, therefore, should look to facilitating the capability to refer with confidence to a single, standard, maintained version of a given piece of work. There are cases in which the widespread availability of different versions of articles has proved useful to researchers and has not caused a problem. Perhaps the most prominent example is arXiv (http://arxiv.org), an e-print service in the fields of physics, mathematics, nonlinear science, computer science, quantitative biology and statistics, now housed at Cornell University. Begun as a preprint archive for the physics community, arXiv provides free and ready access to preprints well in advance of their formal publication in refereed journals, and to growing related content. In part reflecting the communications traditions in the fields involved and the discriminability of arXiv content from subsequent VoRs, this e-print archive effectively complements journals in these fields. However, it is not clear how widely such a system could be duplicated in other disciplines, and even with arXiv, problems of disparity between arXiv preprints and subsequent VoRs can arise.

Thus our call for the clear identification and use of VoR wherever and whenever feasible. The new "CrossMark" initiative announced by the CrossRef organization (see textbox, pg. 14) provides such a mechanism for the VoR to be given an electronic watermark by the publisher so that the stewarded version is properly identified, tracked, and linked from the publisher's platforms to other sites also housing and providing access to the VoR.

5) Government agencies should extend the reach of their access policies through voluntary collaborations with nongovernmental stakeholders.

The preceding recommendations call for federal research funding agencies to develop public access policies that share common properties while also providing flexibility to meet agency-specific needs. We have recommended that the OSTP engage the appropriate agencies and nongovernmental stakeholders to develop and implement such a multiagency public access program, authorized by regulation or legislation.

The development and implementation of a multiagency access program is an essential step in creating a set of interconnected, interoperable databases that will enhance the support of scholarship and increase public access. However, such a program, limited as it is by the boundaries of government authority, cannot on the basis of government authority alone interconnect public access repositories with those in the private sector that hold VoRs within and outside of the U.S . Building an international system that runs across many sectors and many economies, one that encompasses as much of the world's scholarly output as possible, will require that governments, universities and their libraries, and publishers collaborate voluntarily as equal partners.

Such collaborations between government agencies and nongovernmental stakeholders can also resolve the current divergence between fostering maximum interoperability and providing access to the VoR. We have noted that in current capacities, the degree of interoperability possible within highly structured centralized databases substantially exceeds that which is possible across distributed databases. We have called for the use of the VoR whenever possible but also have noted the constraints on government agencies to mandate the use of VoR.

As discussed above (pg. 13), one goal should be the development of interoperability capabilities across distributed databases comparable to that possible within databases. That can resolve any conflict between maximum interoperability and use of VoR as the version in public circulation. During the transition period, however, we encourage scholarly publishers to voluntarily make the VoR of their journal articles publicly available in the designated databases at the conclusion of the embargo period, contingent upon the agencies' including links back to the VoR on the publisher's site. Visible, vigorous government support of the programs called for above to expand and enrich inter-database interoperability will further encourage such publisher participation in federal agency public access programs. As noted in the statement and discussion of the above recommendation, developing a network of fully interconnecting distributed databases will require not only the further development of interoperability capabilities across databases but voluntary collaborations among all participants in the development and management of scholarly publishing databases.

The CrossRef consortium described earlier (textbox, pg. 14) is effective in part because it involves a broad and international spectrum of stakeholders but particularly because it has fostered and empowered the development and application of the metadata standards that underpin inter-journal reference linking. By contrast, one of PMC's greatest strengths is its internal interoperability and its facility to link to objects in other NIH-controlled databases.

We would like to see the development and adoption of some combination of these two approaches and achievements. Additional metadata standards assuredly will be required to maximize the full-text interoperability of the scholarly literature in ways that support improved access, agency portfolio management, and richer scholarship. To achieve their fullest potential, these standards should be universally adopted and applied to facilitate data mining and other robust reuses.

Researchers are finding that the application of search and software technologies across large amounts of information, including journal articles, yields new, valuable research information. Publishers should adapt to such requirements by continuing to work on interoperability standards that facilitate access to the VoR for scholarly text- and data-mining. Journal publishing agreements and other IPR arrangements should recognize the importance of such access for the future of scholarship.

But achieving the full potential of interoperability and reuse across distributed databases, marrying the current and developing interoperability capacities within centralized databases with fully interconnected access to VoRs across databases, will require effective collaboration among government agencies, publishers, universities and their libraries, and the scholarly community. Such domestic collaborations should be extended to international collaborations to capture the full domain of science and scholarship. Dynamic partnerships embracing the key stakeholders—governmental and nongovernmental—as equal partners will provide the most effective mechanism for extending the multiagency public access program we are proposing

beyond its government boundaries to connect all stakeholders and establish functional international connections to an ever broader and richer literature.

6) Policies should foster innovation in the research and educational use of scholarly publications.

Agency policies should encourage the development, in a competitive landscape, of new value-added information products and services that take advantage of a scholarly environment in which articles are increasingly interoperable and available through licenses that support creative reuse. Such development should be carried out on a level playing field among all those who would devise such products and services.

7) Government public access policies should address the need to resolve the challenges of long-term digital preservation.

The importance of long-term preservation cannot be overstated, but the optimal procedure has yet to be identified. For now, we strongly recommend that agencies not put all eggs in one basket. And we sense that distinct mechanisms and structures will be required to sustain, on the one hand, active ongoing scholarship and further improved public access and, on the other, permanent preservation. Sustaining what might be referred to as the "bright" archive of ongoing scholarship and public access will rely primarily on interoperability and metadata standards to connect to VoRs across the various databases where they reside. The "dark" archive (or, more likely, a set of interlinked dark archives) that permanently preserves the complete corpus of the scholarly literature is likely to host duplicate digital copies of the VoR. In the long term, systematic collaborations among stakeholders (government, publishers, universities and their libraries, and other not-for-profit participants in the scholarly publishing system) will be necessary to achieve maximum benefit. Preservation and access are firmly rooted in the mission of libraries, and libraries should play a prominent role in resolving the challenges of long-term digital preservation. For now, it is important and reasonable to expect that works derived from federal funds must be aligned with some reputable preservation system; this preservation objective could be met as a responsibility of authors, publishers, or the funding agencies.[29] We refer readers to the report "E-journal Archiving Metes and Bounds: A Survey of the Landscape," which makes recommendations and suggests some options for such alliances.[30]

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[29] To be clear, we acknowledge that the needs of preservation will generate redundancies internal and integral to the preservation system; where we believe redundancy is wasteful and even harmful are cases where more than one version of an article is searchable and identifiable by the most common means of public access and where agencies' practices unnecessarily duplicate tasks currently done by publishers.

[30] Anne R. Kenney, Richard Entlich, Peter B. Hirtle, Nancy Y. McGovern, and Ellie L. Buckley, "E-journal Archiving Metes and Bounds: A Survey of the Landscape" (CLIR pubs 138), http://www.clir.org/pubs/abstract/pub138abst.html. The Koninklijke Bibliotheek — National Library of the Netherlands (KB)—has established an E-Depot program that is building a repository of international scholarship with an emphasis on long-term archiving, http://www.kb.nl/dnp/e-depot/operational/suppliers/national_suppliers-en.html.

8) OSTP should establish a public access advisory committee.

The landscape of scholarly publishing changes at an astonishing pace and will continue to do so for the foreseeable future. No policies or recommendations written today should be left long unmonitored. To provide a mechanism for periodic assessment of that landscape and of agency public access policies, and to provide a forum for discussion of adjustments and improvements to those policies, we recommend the creation within the federal government of an advisory committee that would perform a periodic, independent evaluation of agencies' public access policies and practices. Such a group, comprising representatives from the various stakeholders—researchers, publishers, librarians and other university administrators, and members of the public—could offer useful perspectives on key issues in the development of the multiagency public access program envisioned here and give ongoing advice as the program operates over time and, we hope, expands into partnerships with external stakeholders. In accordance with our recommendation that the OSTP play a central role in establishing the core properties and operational procedures of federal research funding agency public access policies, we recommend that this committee be advisory to the OSTP.

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These recommendations seek to balance the need for and potential of increased access to scholarly publishing with the need to preserve the essential functions of the scholarly publishing enterprise. In pursuit of a broad, workable consensus, the recommendations call for concessions on the part of stakeholders, but we believe that these proposals sustain the necessary conditions supporting scholarship, quality control, and editorial excellence while specifying concrete steps to ensure the expansion of public access and to improve the usefulness of the literature to researchers. What we recommend here will preserve a commitment to the five principles enunciated earlier and will build a truly collaborative environment for future improvements and innovations. The negative energy that now defines debates over accessibility can and should be turned toward collaboration on ways and means of achieving commonly held goals: not only broad access but better usability, higher confidence in durability and preservation, and a new, transformed system of research publication that incorporates the creativity, the energy, and the imagination of the broadest possible community.

We urge publishers, librarians, universities, and scholars to consider these recommendations as creating an appropriate collaborative environment and putting an end to the previous decade of wrangling over access issues. All can then focus efforts on interoperability, reuse, and preservation with the argument that those features of the whole system strongly support public access; on broad, intelligent use of the products of federally funded research; and on future advances in support of both scholarship and public access to its results.

We venture to speak of this interdependent system of scholarly publishing and the recommendations we have advanced for its productive continuation as a "social compact"—for here, for now, for this exciting moment—that lets publishers of every stripe; researchers with abundant funding and those struggling to establish themselves; and the universities, institutes, and libraries that support them feel genuinely empowered by partnership with federal agencies and the public to innovate, build, create, and develop an environment for science and scholarship that remains the envy of the world — even as it becomes more fully integrated with the exciting and rapidly advancing work of the whole world.

CONCLUSION: "AND I THINK TO MYSELF...WHAT A WONDERFUL WORLD." (L. Armstrong)

We conclude our charge as optimists. We look forward to a developing system of publication in which the products of scientific research are increasingly accessible and increasingly useful; in which boundaries between institutions, disciplines, and nations break down and advance the work of scientists and scholars—in short, a system in which more and better research and scholarship are done and their benefits are more rapidly and usefully appreciated. We do not think it wise to command a sudden break with the past, but we expect the future to surprise us by its imminence. We are all the beneficiaries of visionary work in which the federal government (and many others) has genuinely made possible and indeed facilitated the growth of science and the expansion of knowledge by timely and well-judged interventions. The cyberinfrastructure work of NSF and other federal agencies has helped define a space in which our optimism seems feasible, and the early work of the NIH and its National Library of Medicine, the CrossRef organization initiated by the publishers, and the various consortia that have founded electronic preservation archives have blazed trails in what must have seemed a few years ago like a trackless wilderness.

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Appendix A: Scholarly Publishing Roundtable

Membership

David Campbell, Provost, Boston University

Y.S. Chi, Vice Chairman and Managing Director of Global Academic and Customer Relations, Elsevier*

Paul Courant, University Librarian and Dean of Libraries, University of Michigan

Phil Davis, Ph.D. student in scientific publishing and former librarian, Cornell University

Fred Dylla, Executive Director and CEO, American Institute of Physics

Donald King, Distinguished Research Professor, University of North Carolina School of Information and Library Science

Richard McCarty, Provost, Vanderbilt University

James O'Donnell, Provost, Georgetown University

Ann Okerson, Associate University Librarian, Yale University

Mark Patterson, Director of Publishing, Public Library of Science (PLoS) *

Scott Plutchak, Director of the Lister Hill Library of Health Sciences, University of Alabama, Birmingham

Crispin Taylor, Executive Director, American Society of Plant Biologists

Carol Tenopir, Professor of Information Sciences and Director of the Center for Information and Communication Studies, University of Tennessee

John Vaughn, Executive Vice President, Association of American Universities (chair)

Additional participants

Peter Binfield, Managing Editor, Public Library of Science (PLoS)

Peter Jerram, CEO, Public Library of Science (PLoS)

Mark Seeley, Senior Vice President and General Counsel, Elsevier

Government contacts

Dahlia L Sokolov, Staff Director, Subcommittee on Research and Science Education, House Committee on Science and Technology

Diane DiEuliis, Assistant Director for Life Sciences, Office of Science and Technology Policy

* *Participant, but does not endorse; see http://www.aau.edu/policy/scholarly_publishing_roundtable.aspx?id=6894 for statement*

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