

# Open Access: Unlocking the Value of Scientific Research

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**SUMMARY.** New information and communications technologies are changing the way publishers and librarians view the dissemination and availability of scholarly research. When research results are available widely and freely, science advances most effectively. Due to this and the fact that journal prices are inordinately high, open access in the scientific journal publishing industry has come to the foreground as a widely anticipated cost-reducing option. [Article copies available for a fee from *The Haworth Document Delivery Service*: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>>]

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We see it all around us: industries are changing and adapting in response to new information and communications technologies. In the music industry, for example, a struggle is underway between companies with a financial interest in defending their pre-Internet business model and the demands of the emerging online marketplace. Similarly, journal publishing's entrenched print regime is locked in a battle with those who seek to achieve the benefits of a more open exchange of information by utilizing "open access" publishing strategies.

As we saw with the remarkable international effort to address the SARS crisis in 2003, which relied on the Internet to achieve broad and rapid communication across a research community under the gun to achieve results, science advances most effectively when research results are freely, widely available. So the battle for open access is about more than change in the journal publishing industry. It is about the future of science and how best to maximize the societal benefits of our research investment.

This paper reviews some of the market forces that seem to be driving us toward a tipping point in scholarly communication. It also examines the implications of these changes for libraries and for scholarly societies, two key stakeholders with a financial interest in the outcome.

### ***THE PROBLEM***

For as long as most of us can remember, journal price increases have far outpaced the growth of library budgets. As a result, libraries cannot afford access to the broad range of information needed by researchers. Rising journal prices have forced libraries to forgo the purchase of new journal titles, to cancel subscriptions altogether, and to reduce the purchase of books.

In the print world, this was seen mainly as a library issue. The impact of inordinately high journal prices was largely invisible to faculty and entirely beyond the view of the average citizen. But the Internet and digital publishing technologies—which have raised user expectations and made dramatic gains in cost-effective dissemination feasible—have increased the issue's visibility.

There is growing recognition that scientific communication has insufficiently benefited from the opportunities for global sharing of knowledge. Although the potential of the Internet to reduce costs and expand dissemination was widely anticipated, experience demonstrates

that vested publishing interests—immune from normal market forces because of their control of “must have” content—have blocked the realization of these potential benefits.

It has become far more than just a library problem. As Ross Atkinson put it in a Cornell University statement, “This is not a serials crisis, but rather a broader crisis in scholarly communications.”<sup>1</sup> But libraries play a leading role because they are the primary customers for journals and bear the major overall economic burden of supporting the cost of scholarly publication. The mounting financial pressure on libraries from subscriptions suggests that the traditional economics of scientific communication are no longer supportable. As access to journals declines, efforts may be duplicated, unproductive lines of research may continue, and innovation inevitably slows.

The response of the largest publishers to the potential of the digital networked environment has been to introduce schemes for bundling on-line access to many or all of their journals—“Big Deals”—as they have come to be known. In the short term, Big Deals have been attractive to many libraries because they have driven down the cost per access and furthered the goal of building substantial digital libraries. And discriminatory pricing schemes have made journals more affordable to smaller institutions. Indeed, the Association of Research Libraries (ARL) statistics on serials and monographs spending shows a spike in 2002 in the number of journals available in ARL libraries, probably due to acquisition of bundles. But these statistics also show that expenditures are continuing their rapid rise, and that a unit cost dip in 2001 was only temporary.<sup>2</sup> The fundamental market dysfunctions persist. Indeed, to many the bundling schemes seem more like a means of protecting high-profit revenue streams than a strategy for addressing the problems in the market or furthering the goals of science.

Besides contributing to rising costs, the Big Deal has limited the flexibility needed by libraries to manage their budgets and serve user needs. How severe is this problem? Cornell University, Harvard University, the Triangle Research Libraries Network, the University of Maryland, and a growing list of others have taken the unprecedented step of canceling electronic access to the bundled journal package from the industry’s largest player. A recent survey by Goldman Sachs found that nearly a quarter of librarians planned to cancel or reduce subscriptions to Elsevier’s *ScienceDirect* and another third were demanding price cuts.<sup>3</sup>

As the information content industry analysts at Outsell observed in February 2004:

There is increasing solidarity among the libraries whose budgets are in the middle of the crisis, the faculties whose members contribute the content, and the university administrators who wind up paying the bills. They are taking action to regain control over the millions they spend on content, even at the short-term cost of disrupted consortial deals. Whether or not open access ultimately gains ground as an alternative, it's clear that the current model is breaking up.<sup>4</sup>

### ***IMPACT ON SCHOLARLY SOCIETIES***

The problems arising from high-priced bundles also signal trouble ahead for scholarly societies and associations, along with other smaller players in the publishing field. This is troubling because societies are the communities through which scholars and scientists interact. They play an important role in scholarly communication. For the most part, they are also recognized as providing reasonably priced publications to libraries.

Analysts at Morgan Stanley described the problem this way: "Benefits of scale will increasingly accrue to larger players. Large publishers enjoy economies of scale in an online world because they can bundle their portfolio of journals into a single 'product.'" They conclude "the move to online access may result in larger publishers taking share from smaller publishers."<sup>5</sup>

As the prices of large bundles rise in excess of library budgets, libraries will be forced to look elsewhere for savings. In a letter to faculty about their decision not to renew their contract for the bundled journals of the largest journal publisher, the provosts of Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill forecasted negative developments in continuing the practice. "We are additionally concerned about the detrimental effect such a commitment would have on the scholarly associations and society publishers whose journals would become especially vulnerable to cancellation."<sup>6</sup>

It is a classic business growth strategy in markets where overall spending is stagnant: take revenue away from your competitors. That is why we have seen a wave of mergers and acquisitions in the journal

publishing industry in recent years—a trend that leaves societies on the sidelines unless they decide to sell or lease their journal to a commercial player. But while mergers in competitive markets often result in reduced prices, this has not been the case in journals markets, where mergers have resulted in higher prices.<sup>7</sup>

SPARC Europe’s David Prosser describes the impact of the Big Deal on small society publishers as the “big squeeze”:

The journals produced by small publishers may enter a vicious cycle whereby as they lose subscriptions more quickly, the dissemination and circulation of the work published in them is reduced, resulting in a fall in impact factor. As the impact factor drops, their position on librarians’ “must have” lists falls, leading to even greater cancellations, reduced dissemination, lower visibility and exposure, falling usage, further decreased impact, etc, etc. Conversely, the inessential, low-impact journals from large commercial publishers will have expanded dissemination through the Big Deals, leading to greater impact and a strengthening position.<sup>8</sup>

Clearly, the serials crisis is not just a library problem.

### ***TOWARD A SOLUTION***

The parties to a solution are finally assembling at the table. Libraries have long been there. But now university administrators are paying attention, too. The provost at the University of Maryland wrote to his institution’s faculty that

. . . universities must address this crisis in the system of scholarly communication. Our libraries need our support in their work with the university community to regain control of their budgets, their collections, and the intellectual property that is the ultimate output of the research enterprise.<sup>9</sup>

During their recent “Big Deal” negotiations with Elsevier, University of California administrators provided such support when they stood by their libraries in resisting a fixed 6.5 percent yearly price increase. “The matter has gone to the Committee of Chancellors, which was unanimous in its decision not to negotiate individually with Elsevier as long as the company failed to come to terms on a systemwide agreement.”<sup>10</sup>

Increasingly, faculties have also awakened to the issue. A recent Cornell University faculty senate resolution warns that “current trends regarding serials costs are unsustainable” and posits that “increasing control by large commercial publishers over the publication and distribution of the faculty’s scholarship and research threatens to undermine core academic values promoting broad and rapid dissemination of new knowledge and unrestricted access to the results of scholarship and research.”<sup>11</sup> At the University of Connecticut, a faculty senate resolution states that “scholars and their professional associations share a common interest in the broadest possible dissemination of peer-reviewed contributions,” and cautions that “the business practices of some journals and journal publishers is inimical to these interests and threatens to limit the promise of increased access inherent in digital technologies.”<sup>12</sup>

The next step in broadening the discussion and moving toward solutions may be recognition at a public policy level that scholarly publication must expand access to research material in order to realize the economic and social benefits of a nation’s investment in research. That may be the best way to break through the numerous obstacles to change—enlisting the power of those with a hand on the public purse strings.

But from the perspective of those who are in the trenches, it is clear that solutions will not materialize from thin air but will arise from experience. Fortunately, experimentation is alive and well in the scholarly communications marketplace. Indeed, during the past half-dozen years, a variety of market-based experiments have aimed to expand the dissemination of research. Improved document delivery models, cooperative collection development, site and consortial licensing of electronic information, and development of competitive alternatives to high-priced journals are just a few of the ways different players have dipped their toe in the ocean, testing out the waters of this fast-changing marketplace. Taken together, these initiatives laid the groundwork for fundamental and systemic change by expanding awareness among faculty, librarians, and publishers.

### ***IS OPEN ACCESS THE ANSWER?***

The knowledge gained from these experiments has pointed the way toward what many believe is a scalable solution that addresses the economic dilemma of libraries at the same time as it exploits the potential

of the networked environment. The solution is open access. A growing number of institutions, organizations, and funding agencies believe that open access will break the impasse, sweep away the monopolistic elements of the current system, introduce new market forces more conducive to effective scholarly publishing, and reduce or at least stabilize overall system costs.

Moreover, open access scales far better than subscription access. As knowledge grows exponentially, open access is better able to keep pace:

OA [open access] scales. It greatly reduces the costs of production, distribution, and storage, and of course access and usage are free of charge. OA accommodates growth on a gigantic scale and, best of all, supports more effective tools for searching, sorting, indexing, filtering, mining, and alerting—the tools for coping with information overload.<sup>13</sup>

But open access is not a business model; it is an outcome that may be supported in a range of ways with an infinite variety of business models. These varieties are being worked out in the marketplace and in individual scholarly communities with different traditions and financial dynamics. This is a point IFLA recognized in its “Statement on Open Access to Scholarly Literature and Research Documentation,” which supports “collaborative initiatives to develop sustainable open access publishing models and facilities.”<sup>14</sup>

As with many early-stage initiatives, the definition and goal of open access may vary according to whoever is doing the talking. In 2002, the landmark Budapest Open Access Initiative (BOAI) called for open access to the scientific and scholarly research texts that authors give to publishers and readers without asking for any royalty or payment. The BOAI described open access as

. . . free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.<sup>15</sup>

At a meeting of interested parties hosted by the Howard Hughes Medical Institute in 2003, those present agreed that

An open access publication is one that meets the following two conditions:

1. The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, world-wide, perpetual (for the lifetime of the applicable copyright) right of access to, and a license to copy, use, distribute, perform and display the work publicly and to make and distribute derivative works in any digital medium for any reasonable purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use.
2. A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving.

An open access publication is a property of individual works, not necessarily of journals or of publishers.

Community standards, rather than copyright law, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now.<sup>16</sup>

Both of these statements describe open access from the perspective of its practical implications for information usage. Appropriately, they do not describe how it is to be achieved or sustained. This is a matter on which it would be foolish to be prescriptive. Each scholarly community must flesh out the combination of particulars that best address its unique needs.

For clues to how this process might occur, look at the evolution of arXiv.org, the revolutionary repository for e-prints, which emerged from the need for a better way for the high-energy physics community to exchange preprints. Here open access grew in response to distinct user needs, as an electronic analog to a prevalent print practice, and in



parallel to the traditional publishing system. It has spawned a vibrant “self-archiving” movement and has led to the establishment of other disciplinary repositories and a new wave of institutionally-based repositories.<sup>17</sup>

This kind of organic or bottom-up development can also be seen in the more than 700 journals listed in the *Directory of Open Access Journals*.<sup>18</sup> Most of these arose from opportunities recognized within specific communities and acted upon by utilizing a range of business models, each appropriate to the group it served.

The experiments to date in open access comprise at least nine different “flavours,” according to John Willinsky of the Public Knowledge Project at the University of British Columbia.<sup>19</sup> These are essentially business model variants designed to sustain open access in the context of today’s funding sources and community needs.

In a practical guide to business models for open access journal publishing, Crow and Goldstein suggest that

There is rarely a single component within the funding model for any Open Access journal. Rather, multiple components typically will combine to sustain an Open Access publishing operation. (The combination of funding components applied becomes “The Model” for that organization.) This “three-legged stool” approach also helps to mitigate the effect of any underperformance by a single business model component.<sup>20</sup>

The guide provides an inventory of potential income-generating and subsidy-funding components available to support publication of an open access journal.

Among publishers that rely on very high profit margins, it is unlikely there will be a “gold rush” of early adopters of open access. According to publishing consultant Alastair Dryburgh:

They may in fact need to be dragged kicking and screaming into the new world, and I can see two ways that this could happen. First, if a significant number of funding bodies decide to insist on open access publication, this could tip the balance. Alternatively, it could be technology which does it. Systems for metadata harvesting such as ParaCite offer a way to be directed to a free version of a published paper on an author’s website, institutional website or institutional repository where this is available. If this starts to work for a significant proportion of the literature then subscription

attrition will turn into a rout and open access will become the only viable model for the publication of primary research.<sup>21</sup>

### ***A MATTER OF PUBLIC POLICY***

The coordination problems associated with bottom-up change suggest that top-down action—coming from national governments and funding bodies—may be needed to put open access solidly on track, at least in the near term. Certainly the rationale for this is clear if one accepts that enhanced access will propel science and the social benefits that derive from it. An Australian government report makes the case:

The process of knowledge production is cumulative, with knowledge applied to knowledge, such that knowledge is both an output and an input. How researchers source that knowledge input, how they communicate with each other and how they communicate and disseminate findings are crucial, not only for the progress of knowledge but also for the capacity of the national innovation system to underpin prosperity in the global knowledge economy.<sup>22</sup>

Such benefits far outweigh the dislocations involved in making a change.

In its work on National Innovation Systems, the Organisation for Economic Co-operation and Development (OECD) observed that prosperity in a knowledge economy depends as much, if not more, on the knowledge distribution power of the system than it does on its knowledge production power.<sup>23</sup> Perhaps it is this work that motivated the OECD's recent "Declaration on Access to Research Data From Public Funding"—endorsed by the U.S. and 33 other nations—which expressed the view that "open access will maximize the value derived from public investments in data collection efforts."<sup>24</sup> This view pertains no less to the synthesis of research results published in journals than to the supporting data that was the focus of the OECD communiqué.

As issuance of the communiqué demonstrates, pressure is building, worldwide, to institutionalize a new mode of scholarly communication. In the U.K., the House of Commons Science and Technology Committee has taken the unprecedented step of investigating scientific publishing, in light of concerns about escalating subscription costs. The Committee, which started taking evidence in March 2004, is investigating pricing policies for scientific journals—focusing particularly on Big Deal agreements

as well as open-access initiatives. It may recommend whether the U.K. government should encourage open-access projects—such as BioMed Central, the Public Library of Science, and open archiving—which represent a challenge to traditional pricing models of journal publishers.

Here in the U.S., some government agencies have recognized the role of open access in advancing their missions. The National Institutes of Health developed PubMed Central, the Energy Department has the Eprint Network, for example. These agencies recognize that open repositories of research facilitate discovery and retrieval and thus advance their missions.

But the U.S.'s first, tentative step in the direction of legislating open access occurred when Representative Martin Sabo introduced a bill in June 2003 that would make research papers ineligible for copyright protection if written by scientists who received substantial federal financing for the work. The intent of the bill was to provide free and widespread public access to the papers. It was greeted with an extensive and unprecedented public debate both about open access—the intended outcome of the bill—and about the appropriateness of this strategy for achieving open access. The Sabo bill never progressed, but it sent shock waves through the scientific publishing industry.

### ***SOCIETIES AND OPEN ACCESS***

The Optical Society of America (OSA) launched the open access *Optics Express* e-journal in 1997, and according to OSA publishing director John Childs it is today a successful journal by any measure. An editorial in the first issue suggested some of the promise of open access, even before it had a name:

Authors should be attracted to journals that are free to readers in any part of the world where the Internet reaches, whether or not library subscriptions can be afforded and paid for in local currency. Authors should also be attracted by the opportunity to publish material that is either not compatible with the print medium at all (video clips, for example), or relatively very expensive in print (color graphics).<sup>25</sup>

Another society pioneer was Institute of Physics Publishing, which launched the open access *New Journal of Physics* in 1998 and reported

“massive interest from readers.”<sup>26</sup> Since its online version debuted in 1996, the *Journal of Clinical Investigation* has been freely accessible by all readers, without restriction of any kind. Many more examples of society-published open access journals are to be found in the *Directory of Open Access Journals* (DOAJ). Indeed, over 20 percent of the journals listed in DOAJ are published by learned societies or professional associations.<sup>27</sup>

Yet many societies, despite recognizing the threat posed to them by aggressive commercial publishers, are profoundly skeptical of open access. Their concern often relates to the conversion of existing journals to open access rather than the creation of new journals. Typically they fear the disappearance of surpluses from institutional subscriptions that support other activities of the society.

Although publishing revenues are often used by societies to subsidize their meetings, the American Society for Cell Biology’s (ASCB) annual gathering is a revenue-generator, allowing the society to move towards open access. ASCB was the first publisher to join PubMed Central and today its flagship journal, *Molecular Biology of the Cell* (MBC) offers full free access within two months of publication. According to ASCB executive director Elizabeth Marincola:

I am disappointed that our two-month stand hasn’t inspired more publishers to go with [free access after] two months. . . . Our experience has been entirely positive. When societies say that they can’t take the risk, what they mean is that they are completely dependent on their publishing income. . . . I think the more dependent societies are on their publications, the farther away they are from the real needs of their members. If they were really doing good work and their members were aware of this, then they wouldn’t be so fearful. It has had a very conservative influence on societies.<sup>28</sup>

She is frank about the challenges, but says ASCB is committed to the goal of open access:

Our council has charged the staff with trying to develop a financial plan that will enable us to release MBC immediately for free. It’s not easy—advertising revenues are going down everywhere and there are obvious reasons to be cautious about raising membership dues or annual meeting fees to offset it. We have been tasked with

coming up with a plan to enable us to do this. It is the explicit goal of the society to try to find a way to release MBC without even a two-month delay while retaining our financial base.<sup>29</sup>

At some societies, the discussion of open access is starting to take place among the rank and file. An editorial by the new editor of the American Chemical Society's *Biochemistry* invites ACS members who advocate open access policies to make their views known to the society, stating:

While the ACS was an industry leader in developing electronic archives for its journals, it has yet to implement what the majority of scientists agree is in the best interest of science: a free, publicly accessible electronic archives policy. This has been embraced by competing publications of other scientific societies, particularly those in the realm of biology. I know that some potential authors and reviewers refuse to publish in or review for ACS journals because of this policy. This is obviously not good, as it will ultimately erode the impact of ACS journals. The archives policy is, as it should be, in the hands of ACS governance. ACS governance is ultimately in the hands of the membership. If you believe, as I do, that this is an important issue, become part of the solution and make your thoughts known to the ACS Publications Division, the Publications Committee, and Board.<sup>30</sup>

A recent white paper floated by an officer of another major society was entitled "Open Access to [society name deleted] Publications by 2020?" Its purpose was to introduce the issue to the society's members, and urge them to take a position on open access.<sup>31</sup>

Another society that is taking a proactive approach is the Institute of Mathematical Statistics (IMS), which publishes four subscription-funded journals and, with SPARC assistance, is examining options for making the articles in their journals openly accessible. SPARC is also engaged with various other societies interested in exploring their open access potential.

### ***IMPLICATIONS FOR LIBRARIES***

Perhaps the greatest obstacles to open access today are: the risk that journal publishers will not recover sufficient revenue to cover their

publishing costs or generate a sufficient surplus; and lack of author awareness of the benefits of depositing their work in open access repositories.

Libraries and their institutions are in a position to do something about these obstacles. For example, they can:

- Establish institutional repositories.
- Help faculty archive their research papers—both new and old—in an open repository.
- Help open access journals launched at their institutions become known to other libraries, indexing services, potential funders, and potential readers.
- Insure that scholars at their institutions know how to find open access journals and archives in their fields and set up tools to allow them to access them (e.g., by including the journals listed in the *Directory of Open Access Journals* in their catalogs).
- As open access journals proliferate, and as their usage and impact grows, libraries can cancel over-priced journals that do not prove cost-effective based on use.
- Engage funding bodies in a discussion of open access.
- Familiarize faculty, staff, and administrators with the issues.

Many institutions are taking an important additional step, supporting BioMed Central's open access journals as institutional members. This is an arrangement whereby publication fees that would normally be assessed are forgiven for authors at the member institution. Open access publisher Public Library of Science also has recently announced a membership program. Institutional membership offers sizable discounts on publication fees for affiliated authors—so an institution can reduce any financial barrier to publishing in *PLoS Biology* that its researchers face while sharing publishing costs with funding agencies. The BioMed Central and PLoS institutional membership arrangements may prove to be transitional financing schemes for open access, but regardless of the long-term durability of the specific arrangements, they are helping to encourage the further development of open access publishing.

## **CONCLUSION**

When the creators of the Budapest Open Access Initiative introduced the concept of open access to a wide audience, they wrote: “An old tradition and a new technology have converged to make possible an un-

precedented public good.”<sup>32</sup> The essence of the case for open access is the notion that the public good—the societal benefits derived of our research investment—is better served when barriers to sharing of research have been removed. That belief aligns well with library values.

Today open access is still more of a goal than a business model. There are many particulars to be worked out, requiring shifts in long-standing traditions and adaptation by entrenched financial interests. But the fact that open access is risky for some at this early stage simply means that structural changes need to occur to support its effective implementation.

Ultimately the discussion must move from “why open access” to “how do we best implement open access.” But the first step is acknowledgement among those charged with advancing knowledge—funding agencies and institutions of higher education, in particular—that it is a goal worth striving for. Then we can move affirmatively toward systemic changes that will benefit the academic and research community, and society at large.

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