

Current challenges and choices in scientific publication

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Providing access to scholarly scientific, technical, and medical (STM) information is becoming an increasingly difficult challenge. Authors need to be aware of the barriers facing the timely and widespread distribution of their scientific findings. After all, the dissemination of their findings and their subsequent impact on society are dependent on the success or failure of information distribution, whether in print or electronic form.

ESCALATING COSTS

At the heart of the issue is the escalating cost of purchasing electronic and/or print subscriptions from for-profit commercial publishers. (The publishing arms of learned societies and academic institutions, the other 2 primary sources of scientific publications, are not mirroring this trend. Their profit margins are negligible by comparison.) Most publishers have a dual pricing plan that obliges libraries to pay much higher institutional rates for subscriptions; individuals who purchase their own subscriptions may not be aware of the significant financial burden libraries and research institutions bear. *Table 1* shows the comparative subscription rates for individuals and institutions on several representative refereed medical journals (1, 2). A medical library would pay \$17,516 to purchase this minimal collection, while an individual would pay \$7963.

An additional financial burden for libraries comes from the rapid increase in subscription prices in just the past 4 years. An article by Van Orsdel and Born in the Periodicals Price Survey 2003 section of the *Library Journal* reported that the institutional rates for 1495 periodicals in the health sciences increased by an average of 35.6% from 1999 to 2003 (3). *Table 2* shows subscription prices for each year from 1999 to 2003 for selected cardiovascular journals along with the cumulative percentage increase over 4 years (4).

Other specialties are also seeing dramatic increases in journal prices, as reported by EBSCO Information Services, a leader in providing journal subscription management services to libraries around the world. EBSCO maintains a database of more than 282,000 journal titles representing more than 60,000 publishers worldwide. Drastically escalating costs reported by EBSCO are illustrated by the cumulative institutional subscription rate increases over the past 5 years on the following titles: *American Journal of Nursing* (115%), *Arthritis and Rheumatism* (113%), *Critical Care Nursing* (115%), *European Journal of Surgical Oncology* (74%), *Journal of Experimental Medicine* (62%), *Journal of General Internal Medicine* (67%), *Journal of Head Trauma Reha-*

ilitation (67%), *Journal of Neuroscience Nursing* (93%), *Journal of Reproductive Medicine* (61%), *Journal of the American Dietetic Association* (116%), *Liver Transplantation* (95%), *New England Journal of Medicine* (78%), *Nursing* (65%), *Nursing Management* (132%), and *Pediatrics* (61%) (4).

Library budget increases have not kept pace with journal price escalations and, as a result, libraries have had to cut the number of journal renewals. This ultimately impacts both the author, whose information has less exposure, and the readers, who no longer have immediate access to the information. At the same time, commercial publishers continue to increase profit margins.

A Morgan Stanley September 2002 industry overview of scientific publishing reported a 37% increase in profit for Reed Elsevier scientific core journal titles and a 22% increase for medical titles acquired by absorbing Harcourt in 2001. Reed Elsevier had 32% of the health care publishing market share for 2001, with Wolters Kluwer (22%) and Thomson (20%) coming in second and third (5). Based on the cost history, Van Orsdel and Born made a bleak prediction: "We advise an extremely conservative approach to budgeting for 2004. We predict higher than usual journal increases, just under 12% overall" (3).

Fearing negative repercussions of a seeming monopoly resulting from the 2001 merger of Reed Elsevier and Harcourt, the United Kingdom Office of Fair Trading (OFT) referred the situation to its Competition Commission for investigation. In a statement published in September 2002, the OFT concluded:

- There is evidence to suggest that the market for STM journals may not be working well.
- Many commercial journal prices appear high, at the expense of education and research institutions.
- It remains to be seen whether market forces, perhaps enhanced by the use of new technology, will remedy the problems that may exist.
- For now it would not be appropriate for the OFT to intervene in the market, but the position will be kept under review (6).

Submissions received during the comment period of the investigation expressed concerns about price increases that

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Table 1. Comparison of individual and institutional subscription rates for selected medical journals, 2003

Journal title	Individual cost	Institutional cost	Increase to institutions
<i>AIDS</i>	\$425	\$1,466	245%
<i>American Journal of Cardiology</i>	\$203	\$516	154%
<i>American Journal of Obstetrics and Gynecology</i>	\$195	\$420	115%
<i>American Journal of Pathology</i>	\$195	\$465	138%
<i>American Journal of Psychiatry</i>	\$157	\$399	154%
<i>American Journal of Respiratory and Critical Care Medicine</i>	\$160	\$350	119%
<i>Anesthesiology</i>	\$268	\$491	83%
<i>Annals of Emergency Medicine</i>	\$149	\$260	74%
<i>Annals of Surgery</i>	\$182	\$475	161%
<i>Archives of Physical Medicine and Rehabilitation</i>	\$227	\$324	43%
<i>Blood</i>	\$532	\$915	72%
<i>BMJ</i>	\$220	\$507	130%
<i>Circulation</i>	\$289	\$548	90%
<i>Clinical Orthopaedics and Related Research</i>	\$326	\$701	115%
<i>Computers in Nursing</i>	\$85	\$229	169%
<i>Critical Care Medicine</i>	\$237	\$379	60%
<i>Gastroenterology</i>	\$354	\$605	71%
<i>Journal of Allergy and Clinical Immunology</i>	\$195	\$414	112%
<i>Journal of Clinical Endocrinology and Metabolism</i>	\$342/\$121 members	\$585	71%/383%
<i>Journal of Gerontology</i>	\$222	\$550	148%
<i>Journal of Immunology</i>	\$270	\$620	130%
<i>Journal of Infectious Diseases</i>	\$125	\$535	328%
<i>Journal of Nursing Administration</i>	\$97	\$297	206%
<i>Journal of Pediatrics</i>	\$160	\$406	154%
<i>Journal of Pharmacology and Experimental Therapeutics</i>	\$288	\$661	130%
<i>Journal of Speech, Language and Hearing Research</i>	\$105	\$300	186%
<i>Journal of Substance Abuse Treatment</i>	\$194	\$602	210%
<i>Journal of Thoracic and Cardiovascular Surgery</i>	\$240	\$444	85%
<i>Journal of Urology</i>	\$497	\$556	12%
<i>Lancet</i>	\$146	\$635	335%
<i>Neurology</i>	\$380	\$659	73%
<i>New England Journal of Medicine</i>	\$139	\$499	259%
<i>Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics</i>	\$159	\$359	126%
<i>Transfusion</i>	\$200	\$344	72%

Table 2. Increases in institutional subscription costs for selected cardiovascular journals, 1999 to 2003

Title	Subscription costs					Total increase
	1999	2000	2001	2002	2003	
<i>American Journal of Cardiology</i>	\$245	\$265	\$283	\$301	\$322	31%
<i>Annals of Thoracic Surgery</i>	\$336	\$360	\$360	\$405	\$433	29%
<i>Cardiology Clinics</i>	\$158	\$174	\$198	\$211	\$231	46%
<i>Catheterization and Cardiovascular Interventions</i>	\$1470	\$1610	\$1760	\$1910	\$2095	43%
<i>Heart</i>	\$449	\$511	\$481	\$482	\$590	31%
<i>Journal of the American College of Cardiology</i>	\$286	\$295	\$315	\$346	\$370	29%
<i>Seminars in Thoracic and Cardiovascular Surgery</i>	\$180	\$193	\$212	\$226	\$247	37%
<i>Texas Heart Institute Journal</i>	\$35	\$35	\$70	\$70	\$70	100%

outran inflation, the disparity in prices between commercial and noncommercial STM journals resulting in the exaggerated profitability of commercial STM publishing, and electronic access. Comments were received from over 25 European and US stakeholders, including representatives from medical schools, commercial publishers, libraries, professional societies, universities, and journal editors.

ELECTRONIC VS PRINT FORMAT

A myriad of additional challenges facing the STM publishing industry result from new opportunities in electronic publishing.

Back at the typical academic library, the rush to online-only is accelerating. . . . Faced with the imperative to cut costs, academic libraries of all sizes are abandoning print, despite the unresolved issue of archiving. Print subscriptions are now being cancelled in record numbers (3).

Traditionally, libraries have been the guardians of information, but with the advent of online-only journal publishing, who will play the role of repository in the future? Who will hold the copyright to electronic publications, and who will ensure their permanence for the future? What will be the standard electronic format and protocol, and who will determine them? Do we dare risk leaving this responsibility to publishing houses that may be out of business in the future or to the government whose policy on information access fluctuates with the party in office?

These concerns and many others were addressed recently by a disparate group of stakeholders in the STM publishing community, including authors. The National Academies' Committee on Science, Engineering, and Public Policy conducted a Symposium on Electronic Scientific, Technical, and Medical Journal Publishing and its Implications on May 19–20, 2003, in Washington, DC. An audio archive of the Webcast is available at <http://www7.nationalacademies.org/COSEPUP/Webcast.html>. Presenters for the 6 panel discussions included representatives from for-profit publishing companies, academic institutions, learned societies, and private research institutes representing the fields of information technology, economics, law, library science,

business administration, computer science, engineering, physics, medical informatics, and bioscience. Participants in attendance and remote listeners had an opportunity for discussion and exchange of ideas following each panel presentation. Topics covered included costs of publications; publication business models and revenue; legal issues in production, dissemination, and use; defining publishing in the future; and defining a publication in the digital environment. The symposium had 4 major goals:

- Identify the recent technical changes in publishing, and other factors, that influence the decisions of journal publishers to produce journals electronically
- Identify the needs of the scientific, engineering, and medical community as users of journals, whether electronic or printed
- Discuss the responses of not-for-profit and commercial STM publishers and of other stakeholders in the STM community to the opportunities and challenges posed by the shift to electronic publishing
- Examine the spectrum of proposals that has been put forth to respond to the needs of users as the publishing industry shifts to electronic information production and dissemination (7)

The 2-day dialogue provided an opportunity to air concerns and initiate discussion about solutions to the STM publishing crisis. The symposium was the beginning of a 12-month project that provides a positive platform for change; a report will be issued upon project completion.

INNOVATIVE SOLUTIONS

Other organizations and institutions are taking the initiative to solve problems. Some solutions result from newly created publishing models formed in response to the existing predicament, while others result from new paradigms being incorporated into traditional academic settings. In an effort to build a bridge of communication with the academic and hospital library communities, the *New England Journal of Medicine* has formed a library advisory board to “advise on strategies and policies for a new institutional online license and give perspective on the changing roles and future of medical librarianship” (8).

Two years ago, the Massachusetts Institute of Technology (MIT) Libraries and Hewlett-Packard (HP) Labs began collaborating on a joint project designed to capture, distribute, and preserve the intellectual output of MIT. MIT Libraries and HP Labs released the DSpace system worldwide on November 4, 2002. The system is freely available as open-source software under the terms of the Berkeley Standard Distribution license. The platform enables institutions to capture and describe digital works, allowing access through a search and retrieval system, and provides long-term storage of the works. DSpace accepts all formats of digital material, including documents, books, data sets, and computer programs. This system allows an institution to preserve all of the digital information produced by its community of researchers and authors and makes it available in one searchable database. DSpace can be adapted to meet the needs of the organization and allows the organization to manage its own guidelines for submission (9).

In contrast to the long-standing traditional setting of MIT are newly emerging business models offering solutions for digital preservation. Established in June 1998, the Scholarly Publish-

ing and Academic Resources Coalition (SPARC) advanced its agenda to focus on creating broad and cost-effective access to peer-reviewed scholarship.

SPARC is an alliance of universities, research libraries, and organizations built as a constructive response to market dysfunctions in the scholarly communication system. These dysfunctions have reduced dissemination of scholarship and crippled libraries. SPARC serves as a catalyst for action, helping to create systems that expand information dissemination and use in a networked digital environment while responding to the needs of scholars and academe (10).

SPARC's contributions to a resolution of the publication crisis have been to promote competitive alternatives to escalating journal prices, to serve as a public advocate for change in the publishing system, and to raise awareness of critical issues facing scholarly information stakeholders. An anecdotal illustration of SPARC's efforts to encourage development of high-quality, lower cost delivery channels was reported by Van Orsdel and Born: “*Organic Letters*, a SPARC alternative to *Tetrahedron Letters*, bested its competitor in 2001 impact factors (i.e., number of times an article is cited by subsequent scholars)” (3). *Organic Letters*, published by the American Chemical Society and touted as “the highest ranked letters journal in organic chemistry” (11), has an institutional subscription rate one third that of *Tetrahedron Letters*.

Another alternative publishing model is being offered by BioMed Central, a prime example of open-access publishing. In a recent article in the *BMJ*, Jan Velterop, publisher of BioMed Central, argued, “The underlying problem is that journals are monopolies. . . . The monopolies could be broken by open-access publishing, in which academic institutions pay for publication of their researchers' papers at input, and papers are then made available for free on the Internet” (12). BioMed Central is an independent publishing house whose commitment to scientific publication “is based on the view that open access to research is central to rapid and efficient progress in science” (13). Under this model, original research articles published by BioMed Central are permanently available and maintained online without charge. Articles are peer-reviewed, remain the property of the author, and are archived in PubMed Central. Revenue is generated in part by a \$500 fee charged for each accepted manuscript. BioMed Central has already amassed a prestigious list of international institutional members viewable at <http://www.biomedcentral.com/inst/>. Institutions, organizations, societies, or groups of authors can apply to initiate a journal under their own editorial control using BioMed Central's free publishing format and technical expertise.

SPARC is partnering with Open Society Institute and Lund University Libraries, Sweden, to create a directory of open-access journals in 2003. The Directory of Open Access Journals (www.doaj.org) aims “to increase the visibility and ease of use of open-access scientific and scholarly journals thereby promoting their increased usage and impact.” It “aims to be comprehensive and cover all open-access scientific and scholarly journals that use a quality control system to guarantee the content” (14). “To ensure wide dissemination of the directory, the Open Society Institute will work with the Electronic Information for Libraries (eIFL) network (www.eifl.net), an umbrella organization for national library consortia in nearly 50 countries, to make the directory available to more than 3000 libraries” (8).

Consider another publishing option. In 1991, Paul Ginsparg, a physicist at Los Alamos National Laboratory, created the e-Print Archive.

The Archive allows authors of physics articles to post their papers on-line. . . . Scientists around the world access the Archive to immediately find out about new developments and directions in research, without having to wait for these to appear in a hard copy journal. Posting on the Archive serves authors as an adjunct or an alternative to publication in a traditional physics journal (15).

The archive contains thousands of papers in physics and related fields. It operates with support from the US National Science Foundation, the Los Alamos National Laboratory, and the US Department of Energy and is being mirrored at several sites around the world. Medical specialties might consider replicating this practice to facilitate the immediate dissemination of new research ideas, bypassing the lengthy process of traditional publication.

A significant grassroots effort began forming in 2000 with the drafting of an open letter to the scientific community from Nobel Laureate and former director of the National Institutes of Health, Harold E. Varmus, MD, PhD; Stanford University biochemistry professor, Patrick O. Brown, MD, PhD; and University of California Berkeley biologist, Michael B. Eisen, PhD. The letter called for open access to scientific literature and pledged support to publishers who made research articles available online for free. More than 30,000 scientists from 180 countries signed the letter. Thus was launched the San Francisco-based Public Library of Science (PLOS). PLOS did not originally intend to publish its own journals, but having received less-than-enthusiastic support for the open-access concept from scientific publishers and a 5-year, \$9 million grant from the Gordon and Betty Moore Foundation, *PLoS Biology* is scheduled to be launched in October 2003. *PLoS Biology* is a peer-reviewed scientific journal that will be freely available and reportedly capable of competing with such prominent publications as *Science*, *Nature*, and *Cell*. PLOS plans to follow *PLoS Biology* with *PLoS Medicine* in the near future (16).

PLOS is also supporting legislation introduced in the House of Representatives by Minnesota Congressman Martin Sabo on June 26, 2003. HR 2613, the Public Access to Science Act, argues that information resulting from federally funded research should be freely available to the American public. If the bill becomes law, copyright protection will no longer apply to articles based on federally funded research. The progress of HR 2613 can be followed on the government Web site Thomas at <http://thomas.loc.gov/bss/d108query.html>.

Access to scholarly information is on the threshold of opportunity. Numerous challenges need to be resolved to facilitate the availability of STM publications in the global market. New technology is providing options never before available. In the face of escalating costs and diminishing budgets, creative strategies and legislation are being proposed to ensure the integrity and availability of STM information for the future. Which solutions will thrive remains to be seen. The wisdom and participation of all key stakeholders are required to ensure future success. Consider this article an invitation to encourage your professional colleagues, societies, institutions, and organizations to be part of the process to improve access to scholarly scientific information.

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