

Whither competition?

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Librarians have hotly debated the future of scientific publishing for several years, largely in response to the 'serials crisis' caused by the skyrocketing prices of many scientific journals. Until now, however, the problem has attracted little attention from the very scientists that the scientific communication system exists to serve.

One explanation is that researchers generally do not pay directly for journals, and they are often unaware of issues faced by their libraries. Libraries themselves have shielded researchers from the reality of rising journal prices by engaging in financial contortions. For example, monograph budgets have often been squeezed to pay science, technology and medical (STM) journal subscriptions. This approach is not only unsustainable but also insufficient. Despite such measures, most libraries have been forced to cancel more and more STM subscriptions.

Libraries are embracing substantial changes to redress the situation. In the 1990s, many explicitly recognized the objective of providing access to information, whereas traditionally libraries have emphasized ownership. This represents a fundamental shift for an institution with a centuries-old heritage of developing collections. Library consortia have also emerged as effective in squeezing somewhat better deals out of publishers for electronic licences, thereby increasing access and reducing per-use costs of information. They have demonstrated that demand rises with decreasing prices in the digital world.

But traditions militating against a systemic change in STM publishing - change that would place the interests of science first - are deeply entrenched. Scientists depend on publishing for career advancement, but as they do not pay for journals they have little incentive to stop submitting to high-priced titles. And libraries continue to come under pressure to buy journals, some of which they cannot afford. This fundamental market distortion means that the system as it stands cannot regulate itself.

Indeed, science publishing can be compared with the reform of US election campaign funding. We are asking the chief beneficiaries of the system, the publishers, to reform it. But if the US Congress can reform itself, so perhaps can publishing.

It is important to remember who are the consumers in scientific communication: the authors, who want their work to be widely disseminated and recognized; readers, who would like convenient, barrier-free access; and institutions, which require cost-effective means both to support and evaluate employees, and to teach students.

What is needed is to harness the motives of all the players in the system to best serve the interests of consumers. More effective incentives are needed throughout the system to encourage broad, dynamic, cost-effective communication. The unleashing of competitive forces is fundamental to achieving these goals.

Consumer boycotts are 'powerful weapons'

The thousands of authors who have signed the [Public Library of Science](#) pledge may ultimately represent a potent force for competition. If the journals in which they have published in the past do not comply with their call for open access to back issues, signatories threaten to move to other publication venues that better satisfy their demands for access. Consumer boycotts can be a powerful weapon in a market economy. The current debate also shows how far we have come since the days when discussion of the journals crisis was largely limited to librarians talking to other librarians. Ultimately, however, greater competitive forces must be introduced throughout the system itself.

Although journals run by not-for-profit publishers generally cost less than those produced by commercial publishers, the latter currently dominate the US\$9.5 billion STM information market (*Industry Trends, Size and Players in the Scientific, Technical & Medical (STM) Market*, Outsell, Burlingame, California). The Scholarly Publishing and Academic Resources Coalition ([SPARC](#)), comprising some 200 research institutions and libraries, was launched in 1998 to help not-for-profit and independent publishers inject more competition into science publishing.

Among other things, SPARC has aided the launch of high-quality journals aimed at competing head-on with expensive titles, with its member libraries subscribing to the lower-price version. The most dramatic example of rebellion is perhaps the decision in 1998 by Michael Rosenzweig, a biologist at the University of Arizona, to defect, along with the entire editorial board, from the Kluwer journal, *Evolutionary Ecology*. Rosenzweig had become disenchanted with price increases - averaging 19% annually - at the journal, which he had established a dozen years earlier. So he formed an alliance with SPARC to create an alternative, *Evolutionary Ecology Research*, and sell it to institutions at around one-third of the \$777 price of the Kluwer journal. *Evolutionary Ecology Research* now attracts the top research in the field, whereas *Evolutionary Ecology* has fallen a year behind schedule in publishing issues and recently slashed its price by 40%.

Web 'portals' bring new risk of monopolies

With the advent of the Internet, journals may be supplanted as the basic currency of scientific communication by individual articles or other modules of information. Modular information can be grouped in multiple ways, for example in a narrow discipline-specific, or 'vertical', fashion, or as large aggregations. Increasingly, scientists turn to variants of such aggregations - portals, vortals, communities and channels - which bring together journals in a field, as well as other relevant information. It is therefore essential for competition that no single aggregation be allowed to obtain a monopoly; the dominant channels will set the norms for access terms and pricing.

Many of the large publishers have nearly completed digitizing the archives of their journals, and are moving to the next phase in which they will present vertical channels. Competition in this arena will be broader than that among individual journals; publishers will target authors and users of clusters of related journals, and increasingly the channel's brand may be the main competitive element, as opposed to journals.

Content on such channels may be inextricably interwoven with task-oriented tools designed to hook the user. For example, consider two recent strategic acquisitions of the giant Elsevier Science Publishing: *Endeavor*, a library automation software provider; and *Afferent*, a developer of 'workflow products' for chemists. The potential to integrate journal content tightly with such tools also means that users become accustomed to the system, and can be reluctant to expend the effort and disruption that switching to competing systems inevitably involves. This strategy is aimed at protecting the publisher's high-profit revenue streams.

It may already be too late to ensure competition in some fields where, through acquisitions and

mergers, some publishers have built such a critical mass of content and value-added services that no one can challenge their 'first place to look' status. In other areas, however, the best and largest share of content is still in the hands of scientific societies and others - including some responsible commercial publishers -- who are more motivated by the needs of their communities than are many commercial publishers. But for these players to be competitive on the Internet, they may need to cooperate, sharing the costs of Web infrastructure and assembling a critical mass of content to attract large numbers of users. Only in this way will they be able to offer at a reasonable price the competitive array of services required by the market. [BioOne](#), a collaboration of societies and libraries co-founded by SPARC, is one model. Others include [HighWire Press](#) and [Project Euclid](#), a collaboration between [Cornell University Libraries](#) and [Duke University Press](#) that will offer independently published mathematics journals a shared infrastructure for publishing.

Reinventing scientific publishing

In the long term, the best approach to scientific publishing may be to engineer the separation of the information repository function from the information service function. (This framework has been effectively articulated by [Herbert Van de Sompel](#) of Cornell University and others, and has recently been advanced by release of the Open Archives metadata harvesting protocol (see [Open Archives Initiative](#)). And in this [nature.com](#) web debate, [Steven Harnad](#) has outlined his view of the benefits of institution-based self-archiving.

The pioneering [Los Alamos e-print repository](#) in physics encapsulates this concept of storing the raw literature in free-access databases, with journals, portals and other services acting as value-added overlays. So far, only a few other disciplines have adopted the model, but its time may now have come.

This approach offers the promise of breaking the publishers' monopoly - and the pricing power that goes with monopoly - on unique individual articles. Openly accessible repositories would co-exist with published journals. Since the repository does not answer the need of the scientist to have her work 'certified' (as through peer review) or conveniently accessible, societies and other publishers have a continuing relevance in the scientific communication economy. But their new business models must be based on the utility they add to information.

Imagine if academic institutions, which are the largest source of published research, acting individually or perhaps in concert through library consortia, were to establish e-repositories for the work of their faculty. Government labs and even private industry might do the same. These articles could in turn be 'harvested' for inclusion in journals and portals that support themselves via fees (for example, subscriptions, author charges, sponsorship and advertising, and so on) based on the market value buyers attach to their enhancements and convenience. Perhaps then the market could regulate itself.

Broad adoption of this model has been hampered by the widespread perception of serious stumbling blocks. On closer inspection, however, those concerns most frequently raised seem surmountable: **The risk of making non-peer-reviewed research available.** The fact that authors would need to be affiliated with an institution would already provide a filter of sorts. In particular disciplines, other screening mechanisms could be supplemented if required. Such archives could be provided to researchers, clearly labelled as not having been peer-reviewed; the latter would be left to overlay journals or portals. So free access and minimum screening do seem to be feasible.

Confusion as to what is the 'official' version of an article. This would always be the peer-reviewed version. Reciprocal links could be maintained between the archive reports and the peer-reviewed one.

Ownership. This requires that universities and other institutions work out protocols with their employees recognizing the right of the institution to keep an archive documenting the research conducted there.

Journals may refuse to publish articles that are available in institutional repositories.

Journals will modify their policies if authors collectively insist on it.

Undoubtedly, a large shift in this direction would require careful consideration of these and other obstacles; but the advantages of the access it would offer seem compelling. Institutions are beginning to experiment with the approach. MIT Libraries and the Hewlett Packard Company are developing the [DSpace](#) project, for example, to build a stable digital archive for the intellectual output of MIT's faculty and researchers. DSpace could serve as a model for other institutions, resulting in a federation of systems that make available the collective intellectual resources of the world's research institutions. [CalTech's Scholars Forum](#) and the Open Archives Initiative are two other undertakings aimed at refocusing scholarly communication on the core purposes of scholarship.

The outcome of such experiments is difficult to predict, but it is clear that the Internet is provoking a sea change in the way we think about scientific communication. We now have an opportunity to explore associated issues such as access control, rights management, versioning, retrieval, community feedback, service development and economic models. Academic institutions functioning as repositories would in principle encourage publishers - non-profit and commercial alike - to focus their efforts on providing services on top of these.

There will be no single magic bullet solution to broadening access to scientific information. But the successful reforms will be those that best compete for consumers - authors, readers, and institutions. All of these groups share a desire for broad low-barrier access to the results of research. If they can act together to make the needed changes, the future seems bright for driving down costs and expanding access to scientific data and reports.

Rick Johnson joined SPARC in 1998 as Enterprise Director, and was SPARC's first member of staff. Before joining SPARC, Rick was a publisher involved in academic markets. As Senior Vice President of Congressional Information Service (CIS), a division of LEXIS-NEXIS, and University Publications of America, he led the creation of CIS's first web-based products and built the company's international marketing programme. Earlier in his career, he held positions with the Smithsonian Institution and Mutual Broadcasting System.