Effecting Change through Competition:
The Evolving Scholarly Communications Marketplace[*]

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It was only a couple of years ago that the scientific publishing debate was all the buzz among librarians -- but few others. Years of skyrocketing scientific journal prices left libraries gasping for air, but the problem was little noticed among the scientists for whom the scientific communication system existed.

Journal prices were effectively hidden from view by a system that submerged price signalling to the end user: the researcher-author. As publishers raised prices, libraries inadvertently protected their science faculty from the reality of journal prices. Money was squeezed from monographs to pay the price of fewer and fewer science, technology and medical (STM) journal subscriptions.

Libraries have aggressively advanced solutions and kept the need for change in the spotlight. More than a decade ago many began embracing the goal of access over ownership, a fundamental shift for institutions that have a centuries-old heritage of developing collections. The emergence of library consortia buying has proved to be an effective library strategy to expand access and reduce per-use costs of information. Moreover, they have demonstrated that demand is price elastic in the digital world.

But the traditions militating against systemic change in STM publishing – change which would place the interests of science first – are deeply entrenched. Promotion and tenure and grant-making systems support both the proliferation of articles and the seeming unassailability of high-prestige journals. Libraries, charged with satisfying the information needs of their constituencies, are obliged to subscribe to the prestigious titles as well as the lesser titles -- often regardless of price. The system can't regulate itself. Even the dramatic shift from the print to the digital environment -- and the potential to make ever more research available at lower unit cost -- has not yet broken down the barriers on a broad scale.

It is a little like reform of U.S. election campaign funding. The chief financial beneficiaries of the system have little incentive for change. The impetus must come from the grassroots.

It is instructive to remember who the consumers are in the scientific communication system:
- authors, who seek wide dissemination of and recognition for their work;

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- readers, who seek convenient, barrier-free access;
- institutions, which seek cost-effective means of supporting and evaluating the work of their employees and developing their students.

Those familiar with SPARC (http://www.arl.org/sparc/), a coalition of 200 research institutions and libraries, know it calls for competition among publishers as a means of better serving these consumers. SPARC supports high-quality alternatives to high-priced journals. Among other things, it provides incentives for increasing the capacity of the non-profit sector as a competitive market force. This pragmatic approach grows out of evidence that, even though non-profit journals are generally lower in price and provide better value than commercially published journals, commercial publishers control between 56 and 74 percent of the STM information market.[1]

But the ideal solution (believing for a moment that one exists) does not differentiate between for-profit or non-profit status. Instead it is a system that harnesses the motivations of all to serve the best interests of consumers. The endgame is to create more effective incentives throughout the system and to nurture broad, dynamic, cost-effective communication. The unleashing of competitive forces is fundamental to achieving these goals.

The thousands of authors who have signed the Public Library of Science (PLS) pledge may ultimately represent a potent force for competition. The Public Library of Science, set up by a diverse group of scientists to promote an online public library of science, so far consists of an open letter that has been signed by nearly 25,000 researchers from 166 countries. According to the organizers, the open letter is intended to provide a strong collective voice for scientists in "redefining the terms of our relationships with the publishers of our scientific journals".

From the web site:

> *Using our freedom of choice in a free market, we are offering the publishers of our scientific journals something that they value -the opportunity to profit from our ideas and hard work, and our continued patronage as subscribers - in exchange for something that we value - free and unrestricted access to the published record of our collective work.*

According to the organisers, the letter balances the interests of commercial and non-profit publishers, scientists and the public. In exchange for their role in editing, publishing and peer review, publishers get a six month lease on, rather than ownership of, the original research reports they publish. After that, the published record becomes public domain. The publishers get this six month interval to recover their costs and make a profit, but they don't get to claim permanent ownership of the only permanent record of the scientific progress, paid for by tens of billions of dollars of mostly public money every year, and representing the original ideas and millions of hours of hard work by hundreds of thousands of scientists, and the voluntary participation of hundreds of thousands of patients in clinical studies.

(The PLS open letter focuses on the life sciences because its authors are primarily biologists, and most familiar with the publication practices in the life sciences. They emphasise that they

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[1] Industry Trends, Size and Players in the Scientific, Technical & Medical Market. Outsell, Inc. (Burlingame, CA)

welcome the opportunity to work with others to extend this initiative to other scientific and scholarly disciplines).

If the journals in which PLS signatories have published in the past do not comply with their call for open access to back issues, then they should move to publication venues -- old or new -- that better satisfy their needs. That's competition. And it's a sign of how far we have come from the days of librarians talking to librarians about the journals crisis.

Ultimately, though, we need to build competitive forces into to the system itself. These competitive forces wear a number of different hats, including:

1   Journal Competition

Individual *articles* (and other modular "information objects") available in broad aggregations or vertical market slices -- rather than journals -- may become the basic currency of communication in our newly digital environment. But the *journal* itself in effect represents an affinity group, and the journal's reputation attracts authors. So one approach to changing authors' habits and preferences and enhancing competition is to encourage the shift from an established high-priced journal to a more cost-effective alternative with the same "name-brand" authors. To accomplish this shift requires a better product, the support of an author community, and time. But it is possible.

Before the SPARC partner title *Evolutionary Ecology Research* (EER) (http://www.evolutionary-ecology.com/), for example, there was only *Evolutionary Ecology* (EE), a journal whose price jumped 19 percent per year during a twelve-year period. EER was founded by the editor and entire editorial board of EE, who resigned to protest its pricing and to offer a competitive alternative. Since its very first issue, EER has consistently attracted the top research in the field while EE has struggled just to get enough articles to publish. Perhaps in reaction to this challenge, EE recently reduced its price by 40 percent.

2   Channel Competition

For a journal to be read, cited, and esteemed, it must be used. And increasingly scientists obtain information from what are variously called portals, vortels, aggregations, or information communities -- channels that bring together many adjacent journals and other related information sources. A second competitive force is assuring that no single such channel has a lock on users.

It is increasingly clear that large, well-capitalised publishers, having substantially completed the digitisation of their journals, are moving to the next phase in which vertical channels will be rolled out. Here, must-have content is inextricably interwoven with task-oriented tools designed to hook the user and dissipate price sensitivity. Competition in this scenario will take place at a broader level than for individual journals. It may target authors/users of a cluster of adjacent journals (though, in time, the thread that binds may migrate upward to the new channel's brand).

It may be too late for competition in some fields where -- through years of acquisitions and mergers -- for-profit publishers have built a critical mass of content. All the remaining content

cumulatively is still not enough to challenge their "first place to look" status. And the dominant channel will be the one setting the standard for access terms and price. The main hope here is that the evolution of science in the field will permit entry of new players that can establish their own foothold.

But in other fields, the best and largest mass of research is still in the hands of scientific societies and others that are more intrinsically motivated by the needs of their community. To remain a competitive force, these players need to band together and share the costs of creating/maintaining an electronic dissemination infrastructure and value-added services. BioOne (http://www.BioOne.org), a collaboration of societies and libraries co-founded by SPARC, provides a model illustrating how this might work.

BioOne is a unique aggregation of high-impact bioscience research journals founded in part by SPARC. As an innovative collaboration among scientific societies, libraries, academe and the commercial sector, BioOne is working to help transform the scholarly communication process by providing expanded access to scientific research results. BioOne provides integrated, cost-effective access to a thoroughly linked information resource of interrelated journals focused on the biological, ecological and environmental sciences.

The scores of journals that have come together under the BioOne umbrella have recognized that to remain vital, they must offer a competitive array of services at a reasonable price. And to address the broad digital, networked marketplace, they can't go it alone. A similar motivation drives Project Euclid, a collaboration of Cornell University Libraries and Duke University Press that will offer independently published math journals a shared infrastructure for publishing.

3   Service Competition

Over the long term, this may be the most promising approach to the problem -- certainly it is the most transformative. The idea is to separate out the information *repository* function from the information *service* function.[2] This offers the promise of breaking the publisher's monopoly on individual articles, de-coupling the peer-review process from the registration of research, and encouraging competition in the realm of value-added service delivery.

The Los Alamos pre-print archive (http://xxx.lanl.gov/) is the spiritual progenitor for this, but the core idea may be more generalisable than has to date been demonstrated. (The Los Alamos archive, now called arXiv, was founded 10 years ago by Dr. Paul Ginsparg, a Los Alamos particle theorist. The archive attracts some two million visits a week, according to a recent article in the *New York Times*; more than two-thirds of these visits are from institutions outside the U.S. Estimates are that 35,000 new paper submissions are expected in 2001 alone, and these are in many cases top-quality papers that set the standard for cutting-edge research. ArXiv receives a total of about $300,000 of financing each year from the National Science Foundation, the Department of Energy and Los Alamos National Laboratory).

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[2] 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 at www.openarchives.org. And elsewhere, Steven Harnad has outlined the benefits of institution-based self-archiving (see http://www.eprints.org/).

A scenario may serve to illustrate ways arXiv can be adapted. If academic institutions -- sources of the majority of published research -- were to establish e-print repositories for the work of their faculty, these articles might be harvested for inclusion in journals and topical aggregation services that are purchased for the value of the enhancements and convenience they offer. The unenhanced articles could be made freely available, while services (such as peer-reviewed journals) assembled from repositories by societies and others could be supported via revenue generating business models.

Several key issues need to be addressed for this to be broadly adopted. Some of the most frequently articulated stumbling points, however, seem entirely surmountable:

- *What about the risk of allowing access to non-peer reviewed research?*

A basic form of screening occurs simply by limiting participation to authors affiliated with the institution. It might be feasible or desirable in certain disciplines to implement other internal mechanisms for screening as well. This won't speak to the importance of the research -- that would be left to the selection and review process of the service provider. But it does assure that certain minimal standards are maintained.

- *Which is the "official" version of an article?*

The one that's peer reviewed. Links would be embedded from the repository item to the peer-reviewed and edited version.

- *Who owns the article?*

It doesn't matter, as long as the institution has a perpetual license to make it available in its repository. This will require that universities and other institutions work out protocols with their employees recognising the right of the institution to keep an archive documenting the research conducted there. It will probably be important in the development of such protocols to focus only on the work that does not have commercial value (articles, not books, for example).

- *Will journals publish articles that are available in institutional repositories?*

They will if authors insist on it.

Unquestionably there are other obstacles, but a first wave of institutions is beginning to address these challenges already. For example, the DSpace project (http://web.mit.edu/dspace/home.html) at MIT is being developed by MIT Libraries and the Hewlett Packard Company. DSpace aims to build a stable and sustainable, long-term digital platform for capture, preservation, and communication of 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 (http://library.caltech.edu/publications/ scholarsforum) is another initiative that harnesses the intellectual output of its institution.

These projects, along with sibling initiatives, provide an opportunity to explore issues surrounding access control, rights management, versioning, retrieval, community feedback, service development, and economic models. Perhaps they can also offer an interface for partnerships between universities (as repositories) and societies (as service providers).

Although there may not be a single solution for all of science, successful reform efforts will be those that best compete for consumers -- authors, readers, and institutions. Given the desire of each of these groups for wide, low-barrier access to research, there is certainly room to drive down cost and expand access.