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The High Cost of Scholarly Journals (And What To Do About It)

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The High Cost of Scholarly Journals (And What To Do About It)*

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Why do scholarly journals cost so much? Is it the high costs of publishing or something else? Most importantly, what can be done? These questions have grown in importance over the past several years, but they have assumed new urgency given the extremely tight budgets facing most universities today.

For example, the University of Nebraska-Lincoln library subscription for one year to *The Journal of Physical Chemistry* cost \$3,463 in 2003. *The International Journal of Plant Sciences* cost \$587. *The Journal of Economics and Business* was \$493, *Economics Letters* cost \$1,823, and *Tetrahedron Letters* was a whopping \$10,345 per year. Only the humanities journals provided some relief, with the *Publications of the Modern Language Association* at \$132, *Shakespeare Quarterly* (reflecting a Project Muse discount) at \$40, and *Poetry* at \$39.

Perhaps more alarming, the increase in journal prices has been enormous and virtually constant. During the ten-year period 1993 to 2003, when the Consumer Price Index increased by about 27%, the cost to Nebraska for the *International Journal of Plant Sciences* increased from \$140 to \$587, an increase of 319 %; the *Journal of Physical Chemistry* went from \$1,168 to \$3,463, an increase of 196 %; and the *Journal of Economics and Business* rose from \$180 to \$493, an increase of 174 %; . According to data collected by the Association of Research Libraries (and available at www.arl.org/stats), during the 16-year interval between 1986 and 2001, scholarly journals prices overall increased by 8.5 % per year, while the CPI grew by 3.4 % per year. These differing inflation rates mean that over the entire 16-year period, journal prices jumped by 215%, the CPI just 64%. Journal prices even grew twice as fast as health care prices during the same period. Such increases in journal prices appear likely to continue.

In consequence, research libraries and especially university libraries are perpetually in crisis as they struggle to find enough money to maintain their journal subscriptions--by demanding bigger budgets, by shifting funds from other library operations (e.g., reducing acquisition of monographs),

and by regularly pruning their journals list. All of these strategies have seriously damaged the libraries' effectiveness in supporting research. For example, if libraries cannot provide the most recent research results, scientists will waste valuable time and resources needlessly replicating work that has been done by others, time that could be better spent in building on known research findings.

Of course, consumer complaints of high prices are not very reliable guides to whether prices are *too* high. Whether responding to automobile "sticker shock" or health insurance premiums or the cost of Broadway tickets, high prices often just reflect the high costs of providing the good or service. The same might be true for scholarly journals.

Perhaps the question should be: Despite high prices and inflation, why shouldn't journal prices simply be left to the unfettered private market, like most other prices in our economy? We believe that the answer is that an unexamined reliance on the market has helped create a crisis in scholarly communications. Unless something is done to reverse the situation, serious and perhaps irreparable harm will be done to the nation's research and scholarly enterprise.

The Market for Scholarly Journals

Two features of the market for scholarly journals make it, if not unique, at least unusual. The first is that the specific "product" being sold is one for which the users can find no close substitute. In an ordinary market, say for fast food or computers, when the price of one brand increases too much, consumers begin to switch to an alternative. This possibility, even the threat of it, is an essential part of the competitive process and keeps prices in check. When no shifting is possible – for example, when households buy electricity from the local power company or someone sends first-class mail – prices are usually carefully regulated.

Scholarly journals, as a delivery system, are more like first-class mail than computers. If the price of *Tetrahedron Letters* rises too high, consumers (mostly libraries) cannot switch to a lower-priced journal as a pretty good substitute. Scientists need to keep abreast of the latest work in their field. If the intellectual content of *Tetrahedron Letters* (or any journal) is unique, and if the library's users cannot get access to its ideas or results, there is no good substitute. The library's choice is either to pay the price or have its users deprived of the material; no lower-cost close substitute is possible. As a result, demand for scholarly journals is highly inelastic.

Scholarly journals are not all alike, of course, and the lack of acceptable substitutes more closely characterizes the very high quality, widely respected, and frequently cited journals than it does the much larger group of lower-tier journals. Becoming a top-tier journal is very difficult. Generally a journal gains that cachet only over many decades, by having top scholars serve as referees and as members of the editorial board, and by publishing the work of those who are at the very height of their profession. Thus, the supply of top-quality journals is also relatively inelastic.

The second significant feature of the market for scholarly journals is the substantial and rapidly growing concentration among suppliers. *Ulrich's International Periodicals Directory*

puts the total number of journals now being published at about 161,000, with growth of about 4,000 per year from 1985 to the present. A smaller number might more properly be identified as scholarly journals; for example, among the 100 top-ranked university research libraries in 2002, the median number of periodical subscriptions (most of which presumably are scholarly journals) was 28,031. Of course, fewer still are high quality, widely respected, and frequently cited.

Academic journals are published by scholarly societies, universities, private associations, and, of increasing importance, for-profit firms. Indeed, a relatively small group of commercial publishers have become important suppliers of the scholarly journals, especially the top-tier ones, as the journal lists of for-profit publishers expanded rapidly in the last two decades. The top six companies together publish about 4,000 journals, and the biggest publisher, Elsevier Science (the academic publishing arm of Reed Elsevier Group plc), produces approximately 1,850 journals.

The combination of a product without substitutes and concentration among suppliers of high quality journals might be expected to produce high prices and – until an equilibrium or “maximum-amount-the-traffic-will-bear” is reached – rapid price increases. Mark McCabe’s careful 1998 econometric study (available at www.arl.org) found that “prices are indeed positively related to firm portfolio size [i.e., number of journals published by a firm], and that mergers [of firms] result in significant price increases.”

Still, if high and rising prices merely reflect underlying costs that are also high and rising, then as much as libraries or other subscribers might complain, the prices would nonetheless be justified. Because they are proprietary, direct measures of the producers’ costs are generally not available to test this point, as corporate returns are not frequently broken out in such detail so as to establish cost for a given kind of business. However, there are three strong indirect indicators that suggest the contrary.

First, high and rising prices unmatched by similar patterns in costs would be expected to produce high profits. And indeed, profits among the commercial journal publishers have been very high. Brendan Wiley, in a 1998 study, found the profits of four major commercial publishers of scientific journals to be 18.8% in 1997, more than 3.5 times the average 5% net profit for the periodical industry. Profits for the largest firm in the industry, Elsevier, averaged about 37% between 1995 and 2001.

Second, some journal publishers did not raise prices so dramatically, yet apparently continued to cover their costs, suggesting that rising costs were not the principal driver of higher prices. Prices of journals produced by (non-profit) professional societies increased on average less than those of commercial publishers. Still, some professional societies have come to rely on surpluses (that is, profits) from their journal operations to support their other operations, so even their journal prices are most likely misleadingly high if used as an index of underlying costs. More revealing are a few other examples. The price of the *Journal of Political Economy*, a first-tier journal in economics published by the University of Chicago Press, rose only 48% between 1992 and 2002 (during which time the CPI rose 28 %). The price of the *American Journal of Agricultural Economics*, published by the American Agricultural Economics Association,

increased about 67% over that period. *Shakespeare Quarterly* actually decreased in price, by about 16%, between 1992 and 2002. Examples are not proof, of course, but if these journals can publish, using basically the same materials, labor, technology, mailing costs, etc., as the journals with rapidly escalating prices, it suggests that something other than production costs may be driving up commercial and society journal prices.

Third, scholarly books, which largely involve the same production technology as journals, showed much slower increases in price. According to ARL data, the cost of monographs purchased by libraries rose by 66% between 1986 and 2000, whereas as we saw, prices of scholarly journals increased by 226%. Production costs do not appear to be why journal prices rose more than three times more than book prices.

So there are powerful reasons for believing that high and rising prices are due not to costs, but rather to the combination of highly inelastic demand and suppliers' substantial market power. One might anticipate that high and sustained profits would attract competitors into the industry and thus dilute excess profits. The first part of this hypothesis is true: Between 1986 and 2000, the number of titles (based on *Ulrich*) increased by more than 62%. Unfortunately for libraries and scholars, the annual rate of increase in journal prices remained stubbornly close to 9%, even as many more journals were published. It appears that even as the number of titles increased, so did the market dominance of the biggest suppliers.

Thus, the market for scholarly journals *as currently constituted* appears to be one in which, because of its distinctive features, price competition is weak or nearly absent; a few dominant suppliers extract huge profits; and few of the "self-correction" mechanisms are present that are crucial if markets are to serve the public interest. But there is an additional characteristic of scholarly journals that further undermines reliance on an unregulated market.

Knowledge as a Public Good

Scholarship, and hence the content of scholarly journals, is a public good. A public good is one for which one consumer's use of the good is not competitive with, or exclusive of, another consumer's use of the same good. The classic illustration is national defense – some citizens cannot be defended without all being defended. But an illustration closer to home is a community's clean air – one resident's enjoyment of clean air does not interfere with another's enjoyment of the same "good." So too, one scholar's access to and benefit from the knowledge found in a scientific article published in a scholarly journal in no way limits another scholar's use of and benefit from that knowledge. Lawrence Lessig (in *The Future of Ideas*) and others have termed this type of consumption "nonrivalous."

It has long been recognized that provision of public goods cannot be efficiently organized through the private market. For some public goods such as clean air and national defense, it is technically impossible to exclude users; in such cases, people would not voluntarily pay when they would receive the good anyway, and so the market fails.

For other public goods, where it is technically possible to deny access to non-payers, society gets less than the full benefit of the good if some users are excluded. For example, society's eradication of smallpox produced the public good of a smallpox-free society, enjoyed by everyone. If access to the smallpox vaccine had been left to the private market, rich individuals and individuals in rich countries would have protected themselves but the benefit for the public good would have been lost. Governments and the World Health Organization found these prospects unacceptable and generally either heavily subsidized distribution of the vaccine or distributed it for free, producing the world-wide elimination of smallpox. The market simply failed to be the appropriate device for attacking smallpox, as it usually is in the case of any public good.

Scholarship or knowledge is a public good too, and we should have similar skepticism about whether the unregulated market is the right way to distribute it. The entry of the big commercial publishers into the journals market has been widely noted, but what is not usually recognized is that it is not just a matter of changing journal ownership, of new actors in the marketplace, and of higher prices. *This transformation has largely destroyed the old, university-based system for provision of a public good (knowledge) and replaced it with an inappropriate (and inefficient, in the technical sense) private market, which lacks any provision for handling knowledge as a public good.* Let us consider the journals market again.

The Transformation of the Journals Market

In 1862, President Lincoln signed the Morrill Act, which gave each state 30,000 acres of government land for each of the state's senators and representatives under the apportionment of 1860. The receipts of the land sale were to be invested to support at least one college whose "leading object" was to teach subjects related to "agriculture and the mechanic arts" so as to "promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." Since the passage of the Morrill Act, it has been widely accepted that dissemination of knowledge is a public responsibility. A national commitment to basic and applied research, and the recognition of research as a public good, became more explicit with Vannevar Bush's influential report *Science: The Endless Frontier*, in 1945, and the subsequent establishment of the National Science Foundation in 1950. Now, of course, the federal government spends billions annually on research and development, through NSF, NIH, DOD, DOE, DOA, etc., and private foundations spend additional millions. There is little doubt that without this public subsidization of research, and that by private foundations, our society would be far less advanced in nearly every field.

Scholars have long understood the public-goods nature of scholarship and have organized to ensure that their work is made freely available to the public. This arrangement has been dubbed a *gift exchange*; scholars give free access to their research and in return receive access to the research of others. Until recently, the only major exception to this system was in the area of patentable research, but essentially all other research reports were put into the gift economy. Scholars knew that it was in the interest of science and society for the gift exchange to work smoothly and thus they organized themselves into scholarly societies whose major purpose was

to publish journals that widely distributed the results of their inquiries. Professor Arti Kaur Rai, in a recent paper in the *Northwestern University Law Review*, summarizes this system well: “. . . scientific norms promote a public domain of freely available scientific information, independent choice in the selection research topics, and (perhaps above all) respect for uninhibited scientific invention.”

Beginning in the late 1960s and early 70s, this gift exchange began to break down. A few commercial publishers recognized that research generated at public expense and freely given for publication by the authors represented a commercially exploitable commodity. These firms approached scholarly societies and others with a simple proposition: Let us take over the drudgery of publishing, making financial arrangements, and doing inventory, pricing, and subscription management; this will leave you the refereeing and academic functions. In addition, for the right to manage the business portion of your journal, we will pay a stipend to your scholarly society or university. Reflecting on their experience that their low journal prices usually only covered costs, and sometimes even required subsidies, some of the scholarly societies, universities, and other publishers of journals in the gift-exchange economy accepted these offers.

The commercial publishers, which recognized the relative inelasticity of both supply and demand, acquired top quality journals, and then dramatically raised prices, expecting that they would lose relatively little of the market. They were right. Academics will not accept not having access to the top journals in their fields and demand that their university libraries provide access, regardless of the price. (The tendency to disregard price is aggravated by the fact that journals are paid for by a third-party provider, much as medical care is supplied, and many scholars do not even know the price their library pays for a journal subscription.) The commercial publishers quickly proved that prices could be set far above the level that the scholarly societies had established. Big profits followed.

Unfortunately, many scholarly societies that chose not to sell their journals to commercial companies nonetheless learned a lesson from them and began raising their prices as well. Indeed, Carol Tenopir and Donald King, in a 2000 study (available at www.sla.org), found that between 1975 and 1995, commercial journal publishers raised prices by 310% in constant dollar terms, while society publishers raised prices by 290%. Thus, society publishers were only a little more modest in price increases, remaining close behind their commercial brethren. Still, despite similar inflation rates, journals published by professional societies remained considerably less expensive than those published by commercial firms as their initial prices were fractions of those of commercial publishers; for example, the average library subscription price for a biomedical journal from a commercial publisher in 1998 was \$796, more than double the average \$321 price of a journal in the field published by a scholarly society.

Thus in the last decade or two we have witnessed a dramatic transition, one that is far more fundamental than simply switching from non-profit to for-profit publishers. The old model operated on the basis of gift exchange to ensure wide distribution of what was readily acknowledged, indeed trumpeted, as clearly a public good. The new model operates for profit; if you want access, pay up, and we'll set the prices.

The Consequences of Using a Private Market to Distribute a Crucial Public Good

Library and university budgets generally do not increase at a rate much greater than the consumer price index. The real enemy to acquiring scholarly knowledge is the rate of increase in price, regardless of the initial price of the journal.

For a university library to have maintained its journal collection unchanged from 1986 until 2000 would have required its subscriptions budget to grow by 226%. But there were 62% more journals for libraries to purchase. To keep pace with both price increases and growth in number of journals would have required a budget roughly five times the 1986 budget – an increase of 428%. During this period, the average journals budget of members of the Association of Research Libraries rose 205%. To increase its budget for journals subscriptions, the average library severely cut back on monograph purchases (down by 17%) as well as other services. Even so, as we know, the journals budgets still fell short of what was needed, so the average ARL library also cut the number of its journal subscriptions by 7%.

Interestingly, the most recent data on journal prices and acquisitions collected by ARL show that the cost of the average scholarly journals to ARL libraries dropped by 7.3% from 2000 to 2001. This apparent drop in unit price was accompanied by an increase of 12% in the number of titles acquired. Does this remarkable change in direction indicate that the scholarly journals crisis ended in the year 2000? Knowledgeable library authorities have another interpretation. In their view what happened is that several commercial publishers bundled their electronic journals into a single package referred to by librarians as “the big deal”. Many librarians have signed on to this big deal because it did not increase the total price they were paying for journals from a given publisher. The increase in the numbers of journals acquired and subsequent drop in average price per unit is the result of acquiring additional journals as part of these big packages. Unfortunately, the additional journals acquired were generally not ones that the library placed a premium on acquiring and in signing on to the package of journals the libraries lost the freedom to drop individual journal subscriptions for a period of time (generally three years) and obligated themselves to a fixed inflation rate for the package (often 7% per year) for the duration. While the view of the big deal varies among librarians it is generally thought that, whatever its positive merits, it is a choice forced on libraries by those with significant market power over them. The consensus is that once a library has signed on to the big deal the publisher will be able to exert even more market power over the library.

In a market economy, the response to rising prices of a commodity is either to allocate more money to buy the quantity desired or to buy a cheaper substitute. In a market in which demand is inelastic, the reaction to more purchasing power, e.g., a general increase in library budgets, is simply higher prices. Increasing collections budgets everywhere will only create even more virulent price inflation.

Can university libraries purchase substitute journals? Given the importance that scholars and scientists place on top-tier journals, there are no acceptable substitutes. Thus, libraries tend to respond to price increases for top-tier journals by paying the higher prices, cutting subscriptions to lower-tier journals and purchasing fewer monographs.

What is lost in this bargain? Access to much new science. Journals below the top tier include many specialty-area journals and those in emerging fields. The process of reducing journal subscriptions thus makes the collection less reflective of innovation and focuses on established research in mainstream areas. Many important ideas have come to science through lesser publications. For example, the idea of plate tectonics entered geology as heresy. As evidence supporting the theory grew, articles on plate tectonics gradually appeared in top-tier journals. Access to only the “establishment” journals could tend to ossify science, but this may be one result if subscriptions to less-well-known journals are sacrificed to pay for those considered in the top tier.

Other consequences loom as well. For example, librarians and others now increasingly worry about archiving, especially in the context of electronic journals. If the publisher is a university or professional society, it is likely to have an interest in preserving archives for future scholars. Will for-profit firms have a similar commitment? Will they be willing to subsidize archives, if necessary? What happens when a commercial publisher goes bankrupt or is acquired by another company?

Thus, the irony. Scholarly journals are filled with material that was created by public subsidy. However, access to that material is now increasingly being rationed in a manner most inconsistent with its public-goods nature. It is being rationed by price. Worse, the market in which this material is sold has so such inelastic supply and demand that the result is an increasingly effective transfer of resources from institutional subscribers, especially universities, to the commercial publishers (and some professional societies that emulate them). Had university libraries’ budgets increased fourfold between 1986 and 2000, these market defects would likely have led to dramatically greater price inflation but little or no additional scholarly information. This is the classic public goods situation, in which markets are unable to produce an optimal distribution of the good.

Some Partial Approaches to the Problem

Various possible solutions to the problems we’ve outlined have been suggested, some conventional and others quite novel. It is clearly too early to draw any final conclusions about them, and two or three appear likely to provide some clear benefits. But at this point none of these approaches appears likely to be adequate to the overall problem, in its magnitude and complexity. Let’s consider these approaches.

1. A Buying Cartel. The first solution might simply be to create sufficient market power among buyers to counter the excessive and growing power among the biggest suppliers. If Elsevier Science and other big publishers can use their market power to raise prices, why cannot

libraries create a buying consortium on the other side of the market to exert pressure in the other direction?

There have in fact been some attempts to create associations or consortia that would assist libraries. For example, the recently formed Greater Western Library Alliance (originally the Big 12 Plus Libraries Consortium) is an association of 30 research university libraries designed “to deliver quality cost-effective services and resources required by clients of member institutions through joint action and collaboration.” Through coordination and communication among librarians, and in specific cases by sharing of licenses or other collaborative arrangements, the associated libraries can improve services to their campuses and trim costs.

One major obstacle standing in the way of Greater Western or some other group emerging as a buying cartel for the major universities is that it would likely be found to be in violation of anti-trust laws. Although it would have been stimulated by excess market power among publishers, anti-trust law does not sanction the creation of a countervailing cartel to even things up. A further obstacle is obtaining agreement from a significant number of the research libraries, whose circumstances vary greatly and whose willingness to participate in such an arrangement also varies greatly. But the biggest obstacle is simply this: Universities could not contemplate going without the journals and cannot credibly threaten to do so. Thus their bargaining power is and would be remain very slight.

2. Price Controls and Antitrust. The fact that the journals market fails to have effective price competition, yields excessive profits, and is inefficient for providing a public good does not by itself necessarily imply that society should intervene. For governmental regulation to be effective, there must be both demonstration of an unlawful level of competitive restraint and a showing that there are appropriate remedies that are themselves not more expensive or more damaging than the existing situation. We have had enough experience with direct price regulation, both in individual markets and economy-wide, to know that the resulting dysfunctions often are not worth the gains.

Governmental intervention to make the journals market more competitive might initially seem attractive. But it has been difficult to develop a compelling case within the constraints of anti-trust law, and so it has never really been tried. Even the definition of a relevant “market” is difficult. Journals in chemistry don’t compete with journals in economics, and even within chemistry, the organic chemistry journals compete only slightly with the physical chemistry journals. Partially because of the difficulty of defining market, the Justice Department has not engaged in formal anti-trust activity as mergers and acquisitions have occurred among commercial publishers. An additional complication is that many of the commercial publishers are international, making domestic anti-trust enforcement even more difficult.

3. Novel regulation. A very different kind of regulation has been proposed that could in principle reduce the power of selected actors in the scholarly journal market and have the effect of eliminating the ability of the producer to charge high prices or to raise prices.

Two separate but parallel initiatives have drawn attention. In 1998, one of us, David Shulenburg, proposed the creation of the National Electronic Article Repository (NEAR). Under his proposal, all articles, in the form in which they were published, would be entered into a National Electronic Article Repository 90 days after they appeared, at which time they would be freely available to all. In 2000, a group of scientists centered at Stanford University began the Public Library of Science initiative. This initiative places articles in PubMed Central—a public electronic repository operated by the National Library of Medicine of the National Institutes of Health—six months after they appear in journals. The initiators of the Public Library of Science asked scientists to subscribe to the following pledge: “We will publish in, edit or review for, and personally subscribe only to those scholarly and scientific journals that have agreed to grant unrestricted free distribution rights to any and all original research that they have published through Pubmed Central and similar online public resources within six months of their publication date.” By June 15, 2002, over 30,000 scientists had signed that pledge.

Both NEAR and the Public Library of Science would attempt to continue the current refereed-journal system of scholarly communications while curbing inflation in journal prices and, ultimately, making all of scholarly publishing in science available to the public for free. The first objective is important, as refereed scholarly journals do add value. Their management of the refereeing process creates significant value for scholars, allowing them to rely on published papers as having undergone strenuous review. Managing the review process requires resources; thus both NEAR and the Public Library of Science initiatives would permit journals to have the exclusive right to publish manuscripts for a fixed period of time (90 to 180 days). The assumption is that top research universities would pay to receive scholarly information upon publication, as their researchers would demand it. Journals thus should have subscription revenues sufficient to cover refereeing, editing and other publishing costs. However, very high journal prices or unwarranted price increases would lead some libraries to decline to subscribe and their patrons would have to wait until the material was available for free. This customer option would cause some very expensive journals to cut their prices to retain subscribers, and all of them, society and commercial alike, would be cautious about price hikes.

The Public Library of Science mounted a boycott by scientists in an attempt to compel journals to place all issues older than 180 days into a public archive. In spite of the signatures of more than 30,000 scientists on the petition agreeing to the boycott, however, few journals have capitulated. In December 2002, the Public Library of Science, having failed in its boycott of publishers, announced receipt of a major foundation grant to underwrite the creation of on-line journals to compete with expensive commercial journals. On-going operating costs for these journals are to be obtained by charging authors (or their universities) \$1,500 per article published. This venture eliminates entirely subscription charges but it shifts the cost of journals to research universities. While the overall cost of a journal financed in this manner might be lower than that of commercial journals, it surely will seem inequitable to research universities that they are being asked to pay to publish research in addition to the cost of supporting their faculty who produce the research. In addition, this method of funding is subject to exploitation by commercial journals that, from the authors’ perspectives, publish their articles for free. Indeed, many commercial journals got their start by committing to publish research work free of the “page charges” to authors that society journals were then beginning to charge. Finding

foundation or other sources of financial support to cover such author charges would eliminate this problem but it is doubtful that there is sufficient foundation support available to permit all journals to follow this financial model.

While both NEAR and the Public Library of Science offer novel approaches, a hard-headed appraisal would suggest that they must overcome significant hurdles if they are to transform the scholarly journals market. NEAR of course has never been implemented.

4. New competition. Yet another approach, creating new competitors in the initial marketplace, is in some ways more promising. SPARC (the Scholarly Publishing and Academic Resources Coalition), for example, is a cooperative venture that libraries created to increase competition. A number of journals have been spawned by SPARC to be in direct competition with commercial journals. Products like Bio-One, a collection of scholarly society journals largely belonging to the American Institute of Biological Sciences, have been assembled as an electronic database in an effort to keep those journals available at a modest price. In addition, SPARC has assisted on several occasions when journal editors simply walked away from commercial enterprises and decided to create competitive journals on their own.

SPARC has shown some indications of success. Journals that are facing new competitors have reduced their rate of price increase. In other cases, commercial journals approached financial failure when the SPARC journal became established, leaving the SPARC journal as the remaining venue.

More time will show how effective SPARC is. The difficulty is scale. To date, SPARC has directly or indirectly affected only about 100 or fewer journals out of the 161,000 titles listed by *Ulrich*. Some fear that SPARC will inadvertently increase the problem by adding to the number of journals that libraries must take if SPARC publications compete with, but do not replace, older journals.

5. Open Archives Initiative and Open Access Journals. Cornell physicist Paul Ginsparg initiated an open electronic archive in which more than 70% of all papers published in physics journals now appear either in manuscript or in the form in which they appear in their respective journal. Authors self-archive their work on this site, making it available at no cost to all who want to see it. The cost per paper on the website is \$1 per year. Many academic physicists go to this website first for access to the physics literature. Even if a physicist's university does not subscribe to certain physics journals, all of the physics literature is available through this server. Ginsparg received a MacArthur Fellowship in 2002 in recognition of this effort.

The success of this website has spawned other websites in the areas of psychology, economics, and mathematics, although none of them appears to contain so large a portion of a particular discipline's literature as does Ginsparg's original. At research universities throughout the world there is now much interest in promoting the creation of such open archives that would contain all the research manuscripts published by faculty at each institution. Were every research manuscript placed in such an open archive and were these archives created to common standards, it would be possible to obtain any research manuscript by doing a single world-wide search of

those archives. Such an environment would eliminate the ability of journals to command large prices for journal subscriptions, as there would be no need to subscribe in order to obtain easy access to articles. We note that commercial publishers have not been able to dominate the field of physics, perhaps as a result of the existence of the Ginsparg archive.

At this point, a relatively small and unknown proportion of the scholarly literature is on such institutional archives. Only in select areas of physics is it possible for a scholar to rely on the archives for access to most of the literature. Ultimately we expect that most research universities will develop archives for their faculty's work, but it is not clear that all faculty research will appear on such servers.

While many journals now permit work that they publish to appear (with proper attribution to the journal) on the author's local website, some journals maintain tight restrictions that prohibit consideration for publication if even a near draft of the manuscript submitted to them appears on a publicly accessible website. From their perspective, placement on such a website constitutes "prior publication." Any possibility that putting a manuscript on a website might jeopardize publication in a scholarly journal would ensure that many faculty would not use institutional repositories. If archives do not permit complete access to literature, their presence will not further science or drive down journal prices.

There are many reasons for research institutions to develop open archives even if they are not complete. Without secure electronic archives, many manuscripts that exist only in electronic form will be lost. This fact alone justifies their development.

In April of 2003 meeting in Chevy Chase, Maryland, a group of scientists, including several Nobel Laureates, librarians and scholarly societies adopted a set of principles designed to further the open access model of publication. "Open Access" journals are free to access and are generally refereed. That set of principles affirms the need for all scientific scholarship to be freely available to scholars but specifies that open access models require fees of authors that permit researchers at "demonstrated financial disadvantage to publish" in them. Public Library of Science, a participant in the meeting has agreed that it will not let financial disadvantage prohibit anyone from publishing in its new journals. The Howard Hughes Medical Institute has agreed to cover publisher charges when any of the investigators it funds publish in open access journals. On June 17, 2003, it was announced that all universities in the United Kingdom have become members of the open access group of journals published by BioMed Central and submissions charges will be paid through funding from the UK's Joint Information Systems Committee for all of their faculty members when they publish in the organization's more than 90 peer reviewed journals.

While there is much activity in the open access journal movement, the essential economic facts were well stated by David Prosser in the April 2003 *ARL Bimonthly Report*: "Open access journals are not free journals--only free to the reader. There are significant costs in the peer-review process and production of a journal (even if it is only online). Open access journals will survive only if they can raise sufficient funds to cover the costs of publication (plus whatever profit margin is considered reasonable by the journals' owners and is supported by the market)."

A truly sustainable model must contain a revenue stream that guarantees coverage of the very real costs of producing peer-reviewed journals. Open access journals supported by submission fees would have a revenue stream. However, advocates of open access have not demonstrated that their model would be superior to relying on subscription fees. With no mechanism to reduce costs of publication or to force reduction in profit margins, open access will simply shift the already excessive payment burden from libraries to authors (or other costs centers in the university). University budgets can probably be stretched to cover the costs of open archives provided that such archives emulate the non-refereed, non-edited model of the physics archive.

What's To Be Done? Ensuring Public Access to Publicly-Funded Research

If the crisis in scholarly journals publishing is to end, however, a broader and quite different approach will be needed. The public's and the academy's access to scholarly communication – or more particularly that communication arising from publicly funded research – could be accomplished by a federal law requiring that all research arising from federally funded grants be placed by the publisher in a freely accessible electronic archive within, say, six months of publication in a scholarly journal.

The United States government believes so strongly that research is a public good that NSF, NIH, and the research divisions of other federal agencies are funded with public dollars so that scientists will create research for the benefit of the larger society. It is nonsensical to provide billions each year for research and then completely ignore the mechanism by which the results of that research are disseminated. Since the market does not work to adequately distribute research findings to the academy, the funding agencies should take steps to see that what they fund is ultimately available to researchers for free. Fortunately, there is a simple way to ensure that federally funded research is disseminated.

A federal statute should require that, as a condition for accepting a federal research grant, the scientist or scholar agrees to place each article reporting results from the research in a free, publicly accessible electronic domain after some period, say six months, of exclusive publication in a journal or other medium. The journal publisher would thus temporarily retain exclusive rights to an article and even afterwards would likely continue to find a market for its journals. The journal publisher would be selling the value that the journal itself adds to the article, for example in refereeing, certification, and convenience, rather than the full value--which includes the research itself plus the value added by the journal. Research libraries would pay some price to have the most current research but prices would have to fall from current levels or libraries would wait for free information to become available in six months. (Since the funding agency and the researcher paid for the content of the article, the publisher has no legitimate property claim on its value; the research itself was contributed to the public in the gift economy.)

Publishers could maintain free-access archives on their own servers, but a fail-safe backup would be needed should choice or financial forces cause them not to do so. Federal

research agencies should be required by the statute to make available a permanent electronic archive for receiving these articles and making them available.

Of course private foundations, state and local governments, and foreign governments also fund research. We do not advocate requiring the research they finance to be subject to these provisions, because in the case of private foundations it could threaten the insulation from federal sought by their founders, and in the case of state governments, there is arguably a constitutional conflict. Nonetheless, we hope such entities will seize on the logic used here and choose to follow the same rules that we advocate for publication of the scholarship they fund.

With this simple act, much of the crisis in scholarly communications would end. Those articles deemed to be public goods by virtue of public funding, would be free to all interested parties after a set period. Journals, both societal and commercial, could continue in their traditional roles and could command limited subscription revenue to support their efforts. As a byproduct, the problem of permanently archiving electronic journal material would be assigned to the funding agencies. This aspect of the solution is critically important, as neither lightly capitalized societies nor commercial publishers (who may not have a fiscal incentive to archive material permanently) can be relied on to perform this function. For those who worry about placing this material solely in government hands, the law should permit the free copying by others of all or part of the archive for non-commercial use.

We note with some pleasure that Minnesota Representative Martin Sabo introduced the Public Access to Science Act in June 2003. That act resembles our proposal in that it makes journal articles that arise from federal grants and contracts available for free. Unfortunately it does so by declaring that “Copyright protection . . . is not available for any work produced pursuant to scientific research substantially funded by the Federal Government . . .” This method of making such work freely available has two adverse consequences: First, the removal of copyright protection eliminates all the ownership rights, not just the right to restrict free access to the material. A scientist’s ideas belong to that scientist and that ownership is protected by the copyright act. Without copyright protection one can amend what appears under the author’s name without the author having any recourse. Second, the removal of copyright protection means that no one can have the exclusive right to publish a work even for a limited period of time. Removal of this right severely limits the ability of a journal publishing the work to earn enough from publication to cover costs as anyone is free to publish the same article immediately. Our proposal provides sufficient financial incentive for publishers by permitting a limited window in which exclusive publication rights belong to them, that is a window in which they have something of market value to sell. In addition, there are many large commercial vested interests in the existing copyright law. Removing copyright will needlessly involve them in political maneuvering. By contrast, attaching reform measures to the granting of public funds for research targets the reform to the specific problem of access to scientific research.

The adoption of our plan will constitute a loss to commercial publishers that have been making extraordinary profits by selling public goods at high prices and to scholarly societies that have been supporting non-publishing activities from journal revenues. The adoption of the Sabo plan might result in the loss of all revenues to such journals and ultimately eliminate their

publication entirely. Journals in fields where federal support for research is absent will not be affected. They would remain in the private arena. Journals that publish a mixture of federally funded and non-funded research could choose whether to submit all manuscripts to the archive or only those that resulted from federal support. We would hope that foreign funding agencies would opt to follow the depository plan outlined, as the public goods argument applies fully to the research they choose to fund.

Publishers could decide to exclude any author's research stemming from federal funding and thus exempt themselves from the electronic archive requirement. The value of their journals undoubtedly would fall, however, and eventually their subscription prices would have to fall as well.

The academy and the process of scientific inquiry are suffering because research, much of which is funded with tax dollars for the benefit of the public, is being priced and sold by for-profit publishers and some scholarly societies as a private commodity. Our call is to return the results of publicly funded research to their proper status as a public good.

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