



In the late 1970s, just a few years out of college, I took a job at a publishing company called CIS, which served the government documents library community. We prided ourselves on a close professional working relationship with librarians. One of the things we did was co-sponsor with the American Library Association an annual award recognizing leadership in government documents librarianship.

At my very first American Library Association Conference, we presented this award to Yuri Nakata. I understand Yuri used the money that accompanied the award to establish this lecture series. So here I am, 25 years or so later, wondering if I should thank myself for making it possible to be here today!

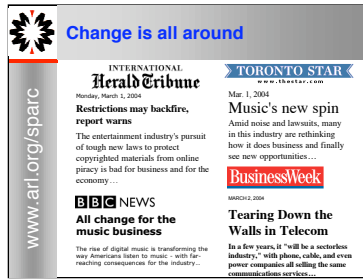
But in all sincerity, I am genuinely honored and humbled to give a lecture that honors Yuri.

I'd like to use this opportunity to talk about free and open sharing of scientific research -- focusing on the rationale for "open access" as a strategy for propelling science and unlocking larger societal benefits. Let me emphasize that I'm not talking about books or software or patents. I am talking about the journal articles that authors have long given to the world without expectation of payment.

It's not a stretch to connect Yuri's interest in government information to our work at SPARC. Scientific research articles, like government publications, can be thought of as what economists call "public goods." More access to public goods increases their societal value. Conversely, limits on availability reduce the societal benefits. With goods whose public benefit is great, market societies often choose to make the goods available for free. Clean air...a national defense system...the judiciary – these are examples of public goods.

The US Congress long ago recognized the public value of government publications, establishing in 1895 the Federal Depository Library program. This acknowledged the societal value of ensuring public access to honest information about its government.

I believe it's time to look at the real value of scientific research articles -- not as articles of commerce, but as public goods whose unfettered availability serves the public interest.



Change in the structure of industries is all around us, particularly where the Internet is a factor. Amazon and E-Bay have revolutionized retailing. In response, traditional players are changing and adapting. The music and motion picture industries also are in upheaval. I suspect few industries are unchanged by the network.

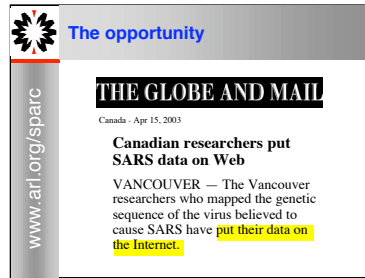
But particularly in information-related industries, a struggle is underway between companies with a financial interest in defending their pre-Internet business model and the demands of the emerging online marketplace.

Now we're seeing the prospect of fundamental change in scientific communication -- a system deeply rooted in traditions dating back to the 17<sup>th</sup> century. And change is not coming easily.

At the heart of the matter is whether the longstanding subscription business model -- in which access to research is rationed out to those who can afford access -- will give way to a new model.

The new model that is taking center stage is called open access. Open access takes advantage of a fundamental economic characteristic of the digital networked environment. I'm talking about the virtual absence of added costs to provide information to additional users after the first one. There is a "low marginal cost of dissemination." That's very different from print, where the printing, mailing, and warehousing costs of serving an additional user were a factor.

So given the low marginal cost of dissemination, our thinking about how to pay for the cost of scientific publication can now focus mainly on recovering first-copy costs.



As we saw with the remarkable international effort to address the SARS crisis in 2003, science advances most effectively when research results are freely shared. When researchers finished mapping the SARS gene, what's first thing they did? Put it on the public internet for *all* to use. They recognized this as a means of rapidly communicating across a global research community under the gun to achieve results.

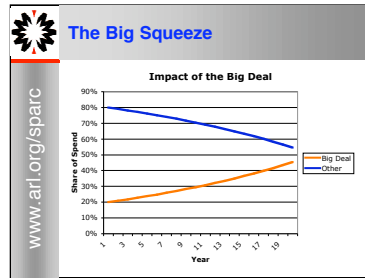
In science, e-mail and the web are now essential tools of collaboration -- eliminating geographic barriers and speeding communication. They have surely fostered the increasing prevalence of interdisciplinary research teams, whose needs are served by broader access to knowledge and cross-discipline transfer.

In some fields, investments in open sharing are widely acknowledged as a means of driving a greater return on the research investment. In biomedicine, for example, we see the substantial benefit generated by the placement of datasets of biological information in publicly available databases.

So there is an important purpose to the open access discussion. The case for open access is about more than a power shift. It is about the future of science. And about maximizing the societal benefits of our investment in research.

It is a conversation we *must* have because, frankly, the current system is “incontrovertibly unsustainable,” to borrow the words of a University of California report.






The ability of libraries to manage costs has been further eroded by the Big Deal. Subscription contracts with the publishers now typically lock in libraries for three to five years. Under these contracts, price increases are likely to exceed growth of the library budget. And there is little or no saving from canceling journals that aren't being used. It becomes an all or nothing proposition.

This chart shows the future we can look forward to if libraries can't manage downward their expenditure on the Big Deal. The bundle claims an expanding share of a library's spending. And to sustain it they'll have to cancel other journals. In a period of less than the career of today's young researchers, we'll see a dramatic change in the makeup of the journals market.

It's savvy business for the large publishers, protecting and expanding their advantage. They enjoy economies of scale in an on-line world because they're able to bundle their sizable portfolios of journals into a single "product" They use this to pursue a classic business growth strategy in markets where overall spending is stagnant. They grow their own business by taking revenue away from their competitors.

That's bad news for scientific societies and other smaller publishers, who will be victims of the "Big Squeeze." The smaller players will lose subscriptions as funds are shifted to sustain the Big Deal. This will drive down their journal's impact. And that will result in further cancellations. It's a death spiral.

This is troubling. Societies are the communities through which scholars and scientists interact. They play an important role in scholarly communication. And for the most part, they are also recognized as providing reasonably priced publications to libraries.



**Awakenings**

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**University administrators back cancellation of the Big Deal**

- Cornell University
- Harvard University
- Triangle Research Libraries Network (North Carolina)
- MIT
- University of Maryland


“Libraries need our support...to regain control of their budgets, their collections, and the intellectual property that is the ultimate output of the research enterprise”  
 -- William W. Destler, Provost, University of Maryland

Libraries can't fix these market dysfunctions alone. But they are doing what they can.

You may have heard recently that Cornell University, Harvard University, North Carolina's Triangle Research Libraries Network, MIT, and the University of Maryland, among others, have each taken the unusual step of canceling electronic access to the bundled journal package from Elsevier, the industry's largest player. These were brave stands, requiring support from provosts and campus communities. Before this, the publisher was in the driver's seat. Contract renewals were taken for granted.

Unfortunately, for these libraries, stepping back from the Big Deal saved little money in the near term,. They pay nearly as much as before to get fewer journals. That's why the Big Deal is so compelling. However, their move did position these libraries to better manage costs in the future. So it was a smart step.

The University of California system -- one of the largest buyers in the world for journals -- also mounted a credible threat of cancellation recently. But the outcome was a little different. Probably because of their size, they were able to negotiate terms that they regard as far more favorable. But it was a holding action -- buying time for a few years.



**Awakenings**

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**Recent faculty resolutions on scholarly communications**

- UC-Berkeley graduate assembly
- UC-Santa Cruz faculty senate
- UC Systemwide Library and Scholarly Information Advisory Committee
- Cornell faculty senate
  - "current trends...are unsustainable"
- North Carolina State University faculty senate
- University of Connecticut
  - "...the business practices of some journals... threaten to limit the promise of increased access inherent in digital technologies."
- Stanford University faculty senate
- Indiana University at Bloomington faculty council

In many institutions faculty are lining up in support of tough decisions by their libraries. Since last fall we've seen a spate of faculty senate resolutions on scholarly communication.

Many of these public statements mention the need to cultivate alternative forms of scholarly communication, and open access in particular, as part of the overall solution. Many of these resolutions recommend that faculty withhold their labor as authors, referees, and editors from journals that aggravate the problem rather than advance the solution.

It's interesting how often faculty agree that their long-term interest in a better publishing system and better journals is more important than their short-term interests.

**Change in the market**

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“...it’s clear the current model is breaking up.” – Outsell (Feb. 2004)

Market forces driving change:

1. Mission of scholarly communication
2. Research library funding constraints
3. Market power of STM giants
4. New publishing models born of the Web


TOWARD THE TIPPING POINT

Over the past two decades, we’ve seen many efforts to come to grips with the stresses on scientific publishing. These have laid the groundwork for fundamental and systemic change by expanding awareness among faculty, librarians and publishers.

Today, as the content industry analysts at Outsell concluded recently: “...it’s clear the current model is breaking up.” Outsell points to several market forces that are changing the scientific publishing landscape...

- First is the mission of scholarly communication. Scientist’s demand for publishing venues and for access to scientific literature -- and the ways they seek and consume knowledge -- have a huge impact on the market.
- Second is research library funding constraints. As I’ve said researchers set the demand for journals, but libraries pay the tab. And the burden is becoming impossible to bear.
- Third, on the supply side, the big publishers are getting bigger. There’s a huge gap between the top players and everyone else. Outsell estimates Elsevier currently holds a 20-25% share of the market. With this power, journal prices will likely continue to rise, regardless of cost efficiencies.
- And finally, there’s the impact of new publishing models born of the web. Immediate adoption by academic and research users is what fueled the growth of the web. But publishing models and scholarly communication paradigms haven’t caught up...not yet. But they will.

The tipping point is drawing closer.



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### Open access

- What is it?
  - free availability on the public internet
  - the literature that scholars give to the world without expectation of payment
- Open access is a goal
- Diverse supporting business models will be fleshed out in the market

Thinking about a scalable solution that addresses the economic dilemma of libraries at the same time as it exploits the potential of the networked environment is increasingly coalescing around open access.

A growing number of institutions, organizations and funding agencies believe that open access will ...

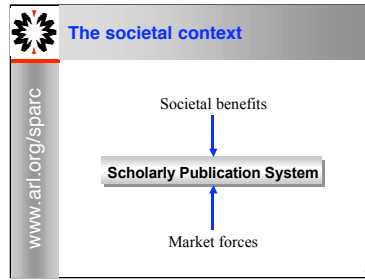
- break the impasse,
- sweep away the monopolistic elements of the current system,
- introduce new market forces more conducive to effective scholarly publishing, and
- reduce or at least stabilize overall system costs.

Open access is a cost-effective way to disseminate and use information. It is an alternative to the traditional subscription-based publishing model made possible by new digital technologies and networked communications.

Open access refers to works that are created with no expectation of direct monetary return and made available -- at no cost to the reader -- on the public Internet for purposes of education and research.

A major 2002 public pronouncement on open access, the Budapest Open Access Initiative, stated that open access would permit users to read, download, copy, distribute, print, search, or link to the full texts of works, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself. Open access does *not* apply to materials for which the authors expect to generate revenue.


But open access is not a business model; it is an outcome that may be supported in a range of ways with an infinite variety of business models. These varieties are being worked out in the marketplace and in individual scholarly communities with different traditions and financial dynamics.



We've talked about the market forces driving us toward open access -- like the library funding crisis, driving change from the bottom up.

But there's also pressure coming from the top down -- and this may be a critical factor. I'm talking about the societal benefits that science is bringing, but which are not being delivered to the fullest because we haven't maximized access to research.

The coordination problems associated with bottom-up change suggest that leadership by national governments and funding bodies is one way to put open access solidly on track -- potentially reducing the duration and disruption of a transition to open access. That leadership might, for example, take the form of government funding agencies acknowledging that dissemination is part of the research process and building the cost of open access dissemination into their funding.



Public good

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Open access leverages investment in research

- Expands and accelerates dissemination
- Exploits economics of Internet -- low marginal cost of dissemination
- Magnifies benefits of innovation
  - Economic (e.g., prosperity)
  - Social (e.g., health)
- Benefits far outweigh dislocations

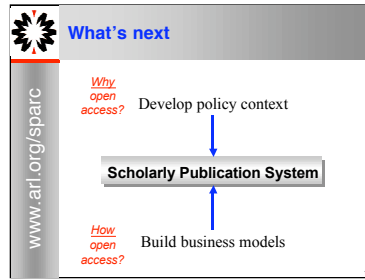
What motivation is there for funders to take this on? It's the opportunity -- or obligation -- to maximize the value of research, which is, after all, a public good.

In its work on National Innovation Systems, the Organisation for Economic Co-operation and Development observed that prosperity in a knowledge economy depends as much -- perhaps more -- on the knowledge *distribution* power of the system as on its knowledge *production* power.

The US Government invests \$50 billion annually in the production of scientific research. Are taxpayers getting full value for money? If research is locked behind toll barriers, are we maximizing the knowledge *distribution* power of the system?

It seems to me that open access offers tremendous leverage on our giant research investment -- expanding & accelerating dissemination, exploiting economics of the Internet, and magnifying the economic and social benefits of innovation.

A shift to open access may bring about some temporary dislocations. But from a societal perspective, there's reason to believe the benefits would far outweigh these.



How will the shift come about? Again, from the bottom up -- via development of sustaining business models. And from the top down -- via development of a supportive policy context within funding agencies and the academy.

In the public policy context, pressure is building worldwide to institutionalize new modes of scholarly communication. In the U.K., the House of Commons Science and Technology Committee has taken the unprecedented step of investigating scientific publishing, in light of concerns about escalating subscription costs. The Committee is currently investigating pricing policies for scientific journals -- focusing particularly on Big Deal agreements as well as open-access initiatives.

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

**Business models**


- Two main routes:
  - Open archives, e.g.:
    - Dspace Digital Digital Documents
    - arXiv.org e-Print archive
  - Open access journals, e.g.:
    - PUBLIC LIBRARY OF SCIENCE
    - BioMed Central
- Many potential supporting business models

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There are still many questions about how an open access system will sustain the very real costs of publication. But that's not surprising given the wide variation in traditions from field to field, the decades of policies embedded in the academy & funding agencies, and the variety of entrenched financial interests.

There are, however, 2 routes to open access being widely explored today: First, open digital archives of pre-prints and postprints of journal articles, technical reports, working papers, data sets, theses and dissertations, presentations, course materials, faculty CVs, and more.

And second, there is open publication via peer-reviewed open-access electronic journals.



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**Business models: Archives**

**Investment in support of institution's mission**


- Expands access to & impact of institution's research
- Increases institutional visibility & prestige by clarifying institutional sources of research
- Demonstrates institution's value to funding sources

Financial support of open archives is usually motivated by a hosting institution's mission. Hence we've seen the development of open archives such as:

- PubMed Central by the National Library of Medicine within the National Institutes of Health
- The arXiv.org physics e-print server, originally developed by Paul Ginsparg at Los Alamos National Labs, which today also serves math, computer science, non-linear science, and quantitative biology
- Plus a growing number of university-based digital repositories. I understand UIC is considering such a program.

At NIH, I think the rationale for their investment in PubMed Central is the benefits that accrue from its usage both by *researchers* and by the *public, who fund NIH*. I'm sure they are cognizant of various factors. For example, the public's well-demonstrated desire for direct access to credible science -- as evidenced by the large number of "public hits" on PubMed and PubMed Central. Also, the demands for accountability regarding how public funds will be parlayed into discovery and treatments that benefit human health. And I imagine NIH is motivated by the increasing attention by the national news media and the medical community to the need for science to be available to patients and their families, students, and global public health practitioners -- those who don't have ready access through subscriptions or licensing agreements.

In a white paper on *university*-based open repositories, SPARC argued that the operational costs are justified by their support of key objectives of a university -- expanding access to and the impact of an institution's research; increasing institutional visibility and prestige by clarifying institutional sources of research; and demonstrating the institution's value to funding sources.



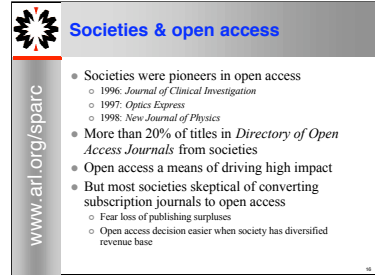
**Business models: Journals**

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<p><b>Self-generated income</b></p> <p><b>Input fees</b></p> <ul style="list-style-type: none"> <li>• Author submission/publication charges or article-processing fees</li> <li>• Off-print sales</li> </ul> <p><b>Affinity relationships</b></p> <ul style="list-style-type: none"> <li>• Advertising</li> <li>• Sponsorships</li> <li>• Co-hosting of conferences and exhibits</li> </ul> <p><b>Alternative distributors</b></p> <ul style="list-style-type: none"> <li>• Convenience-format licenses or distributor format fee</li> </ul> <p><b>Related products &amp; services</b></p> <ul style="list-style-type: none"> <li>• Journal publication in off-line media (print or CD-ROM)</li> <li>• Value-added fee-based services</li> </ul>	<p><b>Electronic marketplace</b></p> <ul style="list-style-type: none"> <li>• Contextual e-commerce</li> <li>• Community marketplace</li> </ul> <hr/> <p><b>Subsidies</b></p> <p><b>Internal subsidies</b></p> <ul style="list-style-type: none"> <li>• Dues surcharge</li> </ul> <p><b>Grants and contributions</b></p> <ul style="list-style-type: none"> <li>• Foundation grants</li> <li>• Institutional grants and subsidies</li> <li>• Government grants</li> <li>• Gifts and fundraising</li> <li>• Voluntary contributions</li> <li>• In-kind contributions</li> </ul> <p><b>Partnerships</b></p>
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In the realm of open-access *publication*, the discussion about business models has mostly focused to date on publication fees -- and who will pay them. In many fields these will be a key component of cost recovery by journals.

But there may be other potential revenue inputs -- as suggested here -- and there will be considerable experimentation to find the best combination for any given journal in any given field. This kind of creativity and diversity can be seen in the more than 800 journals listed in the *Directory of Open Access Journals*, which SPARC sponsors. Most of the journals identified here arose from information sharing needs and opportunities recognized within specific communities. These communities utilized a range of resources and business models, each appropriate to their context.



**Societies & open access**

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- Societies were pioneers in open access
  - 1996: *Journal of Clinical Investigation*
  - 1997: *Optics Express*
  - 1998: *New Journal of Physics*
- More than 20% of titles in *Directory of Open Access Journals* from societies
- Open access a means of driving high impact
- But most societies skeptical of converting subscription journals to open access
  - Fear loss of publishing surpluses
  - Open access decision easier when society has diversified revenue base

There's been a lot of talk about the resistance of scientific societies to open access. This is understandable, but a little ironic since many societies have been open access pioneers.

Indeed, some 20% of titles in *Directory of Open Access Journals* are society-published. For many of these, open access has been a means of getting a new journal off the ground, quickly driving impact upward, and attracting authors in an era when libraries are unable to add subscriptions...and hence readers for the author's paper.


But many societies are nervous about converting existing successful journals to open access, fearing loss of the financial surpluses these generate.

For some societies, however, the decision is less difficult because they have a more diversified revenue base -- the American Society for Cell Biology, for instance. ASCB is less dependent on library subscriptions than many societies because they generate surpluses from their meetings and conferences.

At some societies, the discussion of open access is starting to take place among the rank and file. Earlier this year, an editorial by the new editor of the American Chemical Society's *Biochemistry* invited ACS members who advocate open access policies to make their views known to the society -- whose staff has been vocal in opposing open access.

A white paper floated by an officer of another major society was entitled "Open Access ... by 2020?" It argued that the society needs to consider the inevitability of open access and plan for the society to flourish in that new environment -- for example lobbying for payment of appropriate article charges from government contracts and grants.

Another society that is taking a proactive approach is the Institute of Mathematical Statistics, which publishes four subscription-funded journals. They've embraced a two-tiered system that retains the subscription pricing model, but also posts final IMS articles to arXiv.org e-print repository in math.



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### What can societies do?

**Existing journals – give authors a choice**

- If they pay a publication charge, the paper is made open access on publication
- If they do not pay the publication charge, the paper is only made available to subscribers
- Over time, as proportion of authors who pay increases, subscription prices can fall
- Eventually, entire journal is open access


**New journals**

- Open access may be lower risk
- Don't need to market to libraries
- Focus on authors
- Achieve high impact faster


There are a variety of next steps toward open access for societies to consider.

For example, give authors of papers appearing in existing subscription journals a choice of buying open access for their paper. If they pay a publication charge, the paper is made open access immediately upon publication. If they do not pay the publication charge, the paper is only made available to subscribers. Over time, as the proportion of authors who pay increases, subscription prices can fall. And, eventually, the entire journal can become open access.

For startup of new journals, open access may actually be a lower risk than the subscription model -- since most libraries are more focused on cutting back on journals than adding them today. An open access journal doesn't need to be marketed to libraries. The publisher can focus her energy on authors. And probably can achieve higher impact for the journal far more quickly than if articles were hidden behind a subscription barrier. That's because openly accessible articles are cited more than those that aren't openly accessible.

 **Change seems inevitable**

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“Once the logjam of business models and ‘who will pay’ is broken, a tsunami of pent-up frustration and demand for open access to scientific research is ready to unleash the true power of sharing on the Web”  
— Ousell (Jan. 2004)

What is the chief obstacle to be overcome for open access to take hold and flourish?

We must overcome the risk that publishers will not recover publishing costs. Once the logjam is broken over who will pay, a tidal wave of pent-up demand for open access will unleash the true power of the Web.

The funds to support open access are there. We just need to use them differently and manage the transition. It is time for *funding agencies* and *universities* to begin a discussion about redeploying the funds that they are already putting into research dissemination. As stakeholders, you need to encourage them to have this discussion.



The essence of the case for open access to research -- like the case for public access to government documents that Yuri Nakata made so forcefully -- is that societal benefits are maximized when access barriers are swept away.

In science, knowledge is cumulative, with new knowledge building on old. So *how* we distribute findings is crucial, not just for the progress of knowledge but for the future of science and the public benefits that derive from scientific advances.

Demonstrations of open access are not hard to find today -- there are hundreds of open access journals and scores of open archives. I sense that in the past year the discussion has moved from “why open access” to “how do we best implement open access.”

Granted, many shifts in longstanding traditions and adaptations by entrenched financial interests have yet to occur. But given the promise of open access, we mustn't shirk. Let's get about the task of making open access work... let's unlock the public good of scientific research.