

Summary and Conclusions

There are certain times in history when new possibilities emerge, and the decisions people make can have a profound impact on the world and society, times such as the discovery of fire or the invention of the printing press. The times that we live in are one of these times. The Internet and the globalization of our world that comes from ease of travel, have opened up new potentials that we have only now begun to explore. There is a potential future world where knowledge is shared openly with everyone, and people work together collaboratively to resolve problems and advance our understanding of our world, and ourselves; an age of enlightenment. There is another potential future world where knowledge is seen solely as a commodity to be bought and sold. Which future we choose is up to us.

The heart of librarianship is connecting people with the information that they need. We understand that knowledge is more valuable when it is shared, and librarians are leaders in advocating for the world where knowledge is openly shared with all. There is much to do to achieve this vision, and a few key areas on which we need to focus, including the development of a scholarly communication system for optimal dissemination of information, one which is open access. Open access is scholarly, peer-reviewed literature that is digital, online, free to read and free of most copyright and licensing restrictions. Librarians have a central role to play in ensuring the implementation of such a system of scholarly communication.

Scholarly Communication for Librarians is written from the perspective of a passionate advocate for Open Access and transformative change in scholarly communication, and is based on a course first taught at the University of British Columbia's School of Library, Archival and Information Studies. Topics covered include perspectives from the different groups involved in scholarly communication, including the scholars themselves, journals, publishers, and librarians. There are chapters devoted to Author's Rights and Intellectual Property, Economics, Open Access, and Emerging Trends and Formats. The following summary highlights the major points of each chapter.

Scholars and Scholarly Communication

Knowledge and wisdom did not begin within academe, nor has it ever been confined entirely within its walls. There is a great deal of important learning that has been, and still is, transmitted through oral tradition. While the focus of scholarly communication for the academic librarian is the researchers, faculty, and senior students in our universities and not-for-profit research organizations, it is important to acknowledge and respect these other forms of knowledge.

The current Western tradition of scholarship began in the middle ages, a tradition that began by looking backwards in time to the great days of classical knowledge. This was the beginning of the modern university, which in some ways still retains some vestiges of its medieval beginnings. The university per se is a fascinating topic, and books have been written on this topic.

It takes a long time to become a recognized scholar. First, there is the scholar's education, generally years of undergraduate and graduate work culminating in the Philosophical Doctorate (PhD), or equivalent, through which the scholar illustrates competence to add original knowledge or thought to a discipline, usually in the form of a thesis.

Then, a lucky scholar will obtain a tenure track position (sometimes after a few years as a Sessional Instructor and/or Post-Doctorate Fellow). In order to earn tenure, a process that takes years, and subsequently promotion, the scholar must continue to prove their abilities through publishing, sometimes called publish or perish.

In most disciplines, it is essential to publish in scholarly, peer-reviewed journals. Peer review is a process in which the scholar's work is reviewed by peers (other scholars in the same discipline), usually two or three. The scholar will modify the work according to the reviews before publication.

Peer review is usually blind, or double-blind, meaning that the reviewers do not know the author and vice versa. Peer review is coordinated by editors. There are other forms of quality control in scholarship, such as editorial review, and the PhD thesis process, which involve rigorous review by an expert committee.

In some disciplines, publishing in peer-reviewed journals is not enough. The scholar must publish in the most prestigious journals. In some fields, the Impact Factor of a journal the scholar publishes in is critical in assessing the scholar's work. Impact Factor is a rough measure of the average citation per article of a journal. The Impact Factor is an imperfect substitute for the more pertinent measure of the actual citations per article, and has also been criticized because not all journals are measured; for example, journals from developing countries are almost completely excluded. New metrics such as Eigenfactor are beginning to appear, that provide a more refined method of assessing how often a particular article is cited. Research metrics is an evolving field; there is potential for more and better metrics that will facilitate our understanding of scholarship and how it evolves, but there are also potential dangers in a metrics-based approach.

In some disciplines, such as history and literature, it is the scholarly monograph that is the most common publication venue. The current main focus of change in scholarly communication is the peer-reviewed scholarly journal, and that is the main focus of *Scholarly Communication for Librarians*. It is essential for librarians working in scholarly communication to be informed of current issues relating to scholarly monographs as well; this topic is not covered in this book, but the author highly recommends reading of *The Ithaka Report: University Publishing in a Digital Age*.

Each discipline has its own traditions and culture, and it is important for librarians to understand the context of a discipline in which they interact with scholars or administrators. High-energy physics, for example, has a long tradition of sharing of preprints, first in print and then through the arXiv preprints server. As of fall 2008, the discipline of high energy physics as a whole is in the process of transitioning all its journals from subscriptions to open access, through the SCOAP3 Consortium. Chemistry, in contrast, has shown very little interest in self-archiving, but some interest in working collaboratively wiki-style through the Chemspider database for sharing of molecular structures.

Scholarly Journals

The world's first scholarly journals were published in 1665, first Denis de Sallo's *Journal des Sçavans* in January, followed within two months by Henry Oldenburg's *Philosophical Transactions of the Royal Society of London*. Scholarly publishing was considered radical at the time; not every scholar was keen on the idea of having their work available where anyone could read it, and many were skeptical about any possible benefits of making one's work public like that. It took a century for the Royal Society to consider *Philosophical Transactions* an official publication of the society.

Scholarly journals are produced by, and for scholars, who generally write and give away both the articles and their peer-review services. It is not unusual for scholars to provide free or below-cost editorial support as well. Every scholarly journal has a beginning. Some journals are initiated by individual scholars, but it is more common for journals to be started by groups, usually scholarly societies. A journal needs a community in order to thrive, including authors, reviewers, and readers.

It is estimated that there are about 20-25,000 peer-reviewed scholarly journals in the world today. About half are published by not-for-profit scholarly societies, either independently or through arrangements with publishing companies. Many society publishers are small outfits, producing only one to three journals. About 15% are fully open access journals.

There are many different types and sizes of journals, ranging from the very small, such as the biannual *Connecticut Poetry Review*, to the very large, such as *Analytic Chemistry* which publishes more than a thousand peer-reviewed articles per year.

The cost of journals to the reader or library ranges from nothing, for open access journals, to thousands of dollars per year in subscriptions costs. When comparing the costs of different journals, it is important to take the size of the journal into consideration. One way to compare is to divide subscription costs by the average number of articles published in a year, for a subscription cost per article. This reveals a wide difference in costs for similar journals. *Analytic Chemistry*, published by the not-for-profit American Chemical Society, at \$1,675 US divided by about 1,000 articles, costs about \$1.68 per article. The for-profit Taylor & Francis' *Molecular Crystals & Liquid Crystals* at \$18,048 US produces about 360 articles per year, for a cost of about \$53 / article; a per-article cost 30 times higher than *Analytic Chemistry*.

Staffing at journals will vary depending on size and type. A typical journal will have at least one Editor, to coordinate peer review. Larger journals will have an Editor-in-Chief and/or Managing Editor, to coordinate the work of the other Editors. Most journals have an Editorial Board. Often, a journal will seek high-profile experts in the field to serve on the Editorial Board, to attract the best authors and enhance the prestige of the journal. There may be separate staff for copyediting, proofreading, layout, and artwork at a large journal. At a small journal, everything may be done by just one person. Any of the work at a journal can be done either by volunteers, or by paid staff.

For the past several centuries, scholarly journals have been produced in print, and this is reflected in the form of the journal. Articles are gathered into issues of approximately equal weight, to facilitate shipping and make shipping costs predictable, and then volumes, for binding. The cost of shipping impacts the desired length of articles. There is a substantial art and craft of typesetting for print, to allow for the most words on a page that can be easily read, to cut down on the number of pages to be printed, and often to provide an aesthetically pleasing experience for the reader as well. Colour printing costs more than black and white, and may be avoided, or the publisher may ask the author to pay the colour printing costs.

Most electronic journals have tended to follow the format of print. A few journals are beginning to explore the potential of the electronic medium. An electronic-only journal can publish articles as soon as they are ready for publication. There is no need to restrict the length of an article for shipping purposes, although brevity may still be desirable from the point of view of readability. It is easy to include supplementary materials (or links to supplementary materials), including research data.

Once a journal is produced, it must be *read* to have value. There are many means of making a journal visible to potential readers. Every journal should request an ISSN, and seek inclusion in relevant indexing and abstracting services. Open Access journals can become more visible and ensure they are included in the journal list of many a library if they are added to the Directory of Open Access Journals (DOAJ). Other means of raising awareness about the journal are sending messages to relevant lists, announcements at scholarly society meetings, and advertising.

In this transitional time, many journals are produced in both print and electronic form, with additional costs as compared to production in one format alone. The electronic online format is gradually becoming the norm. New journals are often started up as electronic only.

Publishing: the Scholarly Mission, and the Multi-Billion Dollar Industry

Creating change in scholarly communication means that librarians need to know something about scholarly publishing. This means that we need some understanding of the nature of the mission-driven scholarly society, and the publishing industry as a business.

It is not easy to define scholarly publishing. Rick Johnson, founding Executive Director of the Scholarly Publishing and Academic Resources Coalition (SPARC), characterizes the essential functions of scholarly publishing as:

- Registering the intellectual priority of an idea, concept, or research;
- Certifying the quality of research and the validity of claimed findings;
- Disseminating new research to potential users;
- Preserving the scholarly record for future use; and
- Rewarding scholars for their work

This is among the best definitions of the functions of scholarly publishing, and yet there is not much here that is unique to publishing. Many journals perform all of these functions with journal staff and volunteers. It is the scholars themselves (reviewers) who certify quality. Libraries are involved in disseminating research, and more likely to be responsible for preserving the scholarly record than most publishers. It is tenure and promotion committees that reward scholars, not publishers.

Yet clearly, there are publishers, many of them, and of several different basic types. To understand the nature of a publisher, the key questions are: who owns the organization or business, and what are their goals? To find the answers to these questions, librarians need to look up the ownership chain, and find out what publishers say to their owners. Some publishers present exactly the same messages to every community they work with – scholars, librarians, and owners, while others present very different messages to these different communities.

The scholarly society is an organization of scholars, reporting to scholars. The primary mission of the scholarly society is scholarship. For example, the priorities of the U.K.'s Royal Society, publisher of *Philosophical Transactions*, are nurturing future science leaders, influencing public policy decisions with authoritative and independent scientific advice, and inspiring interest in the wonder and excitement of science. The 2006/2007 *Review of the Year* includes financial information, which takes up about 15% of the total report, but the primary focus is on scholarship, and the report on the publishing program highlights scientific work, such as the first live observation study of a giant squid.

The Indian Association of Gastro-Intestinal Surgery is a fairly typical society publisher, of the *Journal of Minimal Access Surgery*. The Association calls on its members to advance the cause through sharing of articles and videos on laparoscopic surgery. A recent newsletter proudly announces that the Association has met one its goals: every small village in India now has access to minimal access surgery.

Until the middle of the last century, almost all scholarly publishing was done by society publishers. An increase in research funding by governments in many countries after the Second World War created an increase in the need for journals in which to publish this research, and an opportunity for the commercial market. Now, about half of all scholarly journals are published by for-profit commercial publishers, sometimes in partnership with scholarly societies.

While there are hundreds of publishers involved in scholarly publishing, the commercial market is heavily dominated by just four publishers: Elsevier, Springer, Wiley, and Taylor & Francis. Today, these four publish more than 6,000 journals, a substantial portion of the world's scholarly journals, and a particularly large portion of the highly lucrative Science, Technology, and Medicine (STM) market.

The staff of these publishers who work with the journals, authors, and librarians, are focused on the production and dissemination of scholarly articles and books, and work in a manner that is very similar to the scholarly societies. A very different picture emerges, however, when we look at the owners of these companies, what their goals are, and what these companies say when

they report to their owners.

All four companies are publicly traded corporations. They report to shareholders, and the purpose of the corporation is the bottom line: profit.

The largest of the publicly traded companies is Reed Elsevier. The 202 page Reed Elsevier 2007 Annual Report, after a brief preamble, which touches on scholarship, focuses almost exclusively on financial information – such as close to a billion U.S. in profits, and a profit margin of over 30%. Unlike the Royal Society, Reed Elsevier does not appear to presume that their shareholders would be interested in any increase in interest in the wonder and excitement of science.

Another way to understand a company is to look at its mission, vision, goals, or key performance measures. In 2007, the Key Performance Measures for Reed Elsevier were:

Reed Elsevier Key Performance Measures, 2007

Revenue

Adjusted operating profit

Adjusted operating margin

Adjusted profit before tax

Effective tax rate on adjusted profit before tax

Adjusted profit attributable to shareholders

Adjusted earnings per share

Adjusted operating cash flow

Constant currency growth

Underlying growth

Return on capital employed

For the *Indian Association of Gastro-Intestinal Surgeons*, a key goal (roughly equivalent to a Key Performance Measure) would be the number of villages where minimal access surgery was available; for the *Royal Society*, successful workshops and events, and advances in scientific discovery published. For Reed Elsevier, scholarship, and real-world benefits derived from scientific advances, is simply irrelevant except as a means to the *real* goal, profit.

The second-largest company is *Springer*, owned by *Cinven and Candover*, which describes itself as “*Europe’s largest buy-out company*”. While the Springer salesperson who comes to visit likely does not say much about this, it is very clear from the website of the owning company that there is only one issue of real interest: profit. The company’s strategy is to buy companies and then sell them within a few years for more than they paid. It is hard to imagine how this could happen with Springer, without further exacerbating the serials crisis.

Wiley and Taylor & Francis present similar pictures of profit-oriented ownership, and exceptionally high profit margins.

The profits of these four companies are not typical in the business sector. One reason is that the element of *competition* is missing from scholarly publishing. Each article is unique, and hence every journal is a kind of monopoly. The researchers who both produce the articles and read them have not been involved in the economics; they do not pay for the journals, the library does. The scholarly publishing market has been described as highly dysfunctional.

Not all commercial companies are publicly traded. There are also private for-profit companies, often family owned, such as the MacMillan company, which owns the *Nature Publishing Group*. Many of the publicly traded companies began as independent private companies. The key difference is that the privately owned company is free to set its own goals. This does not mean that private companies are good, and public corporations bad; just that private corporations *can* decide that other things besides profit actually matter. Mary Anne Liebert owns her publishing

company, and describes her staff as family.

The for-profit companies are not alone in the pursuit of profit from scholarly publishing. Some of the scholarly societies behave very much like the publicly traded corporation, valuing profits from scholarly publishing over the best interests of scholarship.

Over the past couple of decades, the trend has been towards merger and consolidation in scholarly publishing. This has been a great concern for libraries, with mergers often opposed by libraries under the umbrella of the Information Access Alliance, as prices have tended to rise sharply (typically tripling) after each merger. One of the driving forces behind the trend towards merger and consolidation was the cost and difficulty of moving into the online environment in the early days. Technology has evolved; what was difficult has become easy, and the landscape for scholarly publishing has begun to change.

Where once even a large company with hundreds of journals may have found it impossible to move online on their own, now there is free, open source software, and often library support, so that any one journal can fairly easily manage this transition on their own. This is not always necessary, as publishing cooperatives offer a new means for not-for-profit journals to work together to take advantage of economies of scale, while still remaining independent.

Librarians and Libraries

Librarians are scholars too. It is useful to explore our own scholarship as one example of scholarly communication, to see scholarly communication from the scholar's point of view. If we want scholars in other disciplines to create transformative change in their scholarly communication, then we have an obligation to do likewise. Like other disciplines, the cost for subscriptions on a per-article basis in LIS varies a great deal, in at least one instance by more than a hundredfold for journals that publish similar articles. The highest subscription costs are from commercial journals. The lowest are from our library association journals. Why do librarians continue to write, review, and edit for high-priced journals, when we have low-cost options, including many fully open access LIS journals, at our fingertips?

Open access means access to everyone. With respect to LIS literature, this is particularly pertinent to our professional colleagues outside of the university libraries with LIS programs. Open access makes a huge difference in access to the professional literature for the practicing professional outside of a major urban centre. This is helpful in understanding how open access can facilitate evidence-based practice, whether in librarianship or any other profession.

Library collections are in a process of shifting from print to online. In the past few decades, along with the serials crisis, libraries have experienced a series of shifts in formats and perspectives, from print to online dialup CD-ROMs to the World Wide Web, from "just in case" to "just in time" purchase, with more emphasis on interlibrary loans and less on collections, to licensing or temporary leasing of electronic resources stored remotely on vendor's websites, to new technologies that make it possible once more to develop local collections, this time in electronic form.

The library is more than a collection; the academic library is the primary support for scholarly communication. If every library makes similar collections decisions based on similar criteria such as usage statistics, the impact on scholarship could be profound. There are research areas that may have low usage, but are very important. Consider, for example, how small the research community studying any one particular endangered species might be.

Similarly, with human illnesses, certain diseases such as heart, stroke, and cancer, are very common and the subject of much research. Other illnesses are less common, even rare, and fewer researchers focus on these. Again, this literature will generate less usage.

If every library makes decisions about purchasing or supporting scholarly communication on a usage basis, there is a risk that these smaller research communities will lose needed support. Without publishing venues, it will be more difficult to attract researchers into these niches.

Librarians are taking on new roles in scholarly communication, providing education and support services such as institutional repositories and publishing services.

Librarians through library associations have been leaders in advocacy for transformative change in scholarly communication, including open access. The Association of Research Libraries developed the Scholarly Resources and Academic Publishing (SPARC) Coalition in 1998, to create change in scholarly communication. Library members of SPARC commit funds to support SPARC initiatives and partners, ranging from individual journals to open access publishers such as *Public Library of Science* and the *Stanford Encyclopedia of Philosophy*.

Author's rights and intellectual property

The World Intellectual Property Organization (WIPO) identifies two basic types of intellectual property law, industrial property (e.g. patents, trade secrets), and copyright. This distinction is important, because the nature of the legal protection is very different. For example, patent law covers processes or ideas for businesses. The patent itself is public information, but making use of the idea or process requires a license. In contrast, copyright law covers the *expression* of a work, but never the underlying facts or ideas. It is not legal to copy and sell the whole of *Scholarly Communication for Librarians*, but if anyone reads the work and is inspired by the ideas in it, they are free to make use of these ideas without asking permission.

Scholarly communication in the form of published works falls under copyright law. While each country has its own laws, there are international treaties such as the Berne Convention, which most countries have signed. Copyright is automatic; the creator does not need to take any action for their work to be covered. Every written expression – every e-mail, blogpost, and listserv message – is covered by copyright. Copyright originates with the author/creator, with rare exceptions, unless the author/creator decides to transfer rights to someone else. The exception is work for hire; for example, when a researcher is working *for hire* for a government department, the copyright belongs to the government department. Researchers working for universities are *not* considered to be working for hire.

There are two basic types of rights in copyright: economic rights, and moral rights, with the notable exception of the United States, where moral rights are not recognized. Economic rights are the right to exploit the work for monetary gain. Moral rights include the right to attribution, and to integrity of the work. Moral rights generally continue even after transfer of all economic rights in a work.

With scholarly works, copyright never originates with the publisher. Many traditional publishers ask scholars to sign a *copyright transfer agreement*, transferring some or all economic and moral rights to the publisher. In an extreme case, an author may sign over all rights, leaving the author with no rights to re-use their own work, not even to hand out copies to their own students in their own classroom.

It is not necessary for authors to transfer copyright to publishers in order to publish. All that the publisher really needs is a legal right to publish. There is an authors' rights movement, and librarians are at its forefront, providing education and support to authors wishing to retain their rights.

One option for authors is to seek to publish in a journal that allows them to retain copyright, as most open access publishers do. Another option is to at least seek a journal that will allow them to retain some rights, for example rights to self-archive for open access. The Sherpa RoMEO *Publisher Copyright Policies & Self-Archiving* site provides links to information for authors on

where they can publish and still retain rights to self-archive their works. Authors can also use an Author's Addendum, in which they sign a standard Addendum and attach it to the publisher's copyright transfer agreement, indicating the rights that they plan to retain. Authors' Addenda are available from the Scholarly Publishing and Academic Resources Coalition (SPARC), and the Scholar's Copyright Project.

Publishers' agreements are in a time of transition. About a third of publishers no longer seek a copyright transfer agreement, but rather a *license to publish*. A license to publish may leave the author with more rights than a standard copyright transfer agreement, but there is no guarantee, so it is a good idea to read the fine print. Publishers are also in a time of transition with respect to self-archiving policies. This appears to be a reaction to research funding agencies' open access mandate policies. Even publishers that generally do not allow author self-archiving may have special arrangements for authors covered by specific research funding agency policies.

Some publishers, particularly open access publishers, are moving to Creative Commons licensing. Creative Commons provides an easy means to create licenses that are easy to read and understand for humans, machines, and lawyers. Obligations and rights for users are spelled out clearly, simply, and in a standard way for different items.

Copyleft is an emerging area in intellectual property, common in the open source software movement. Copyleft licenses such as the GNU General Public License are considered viral, in that not only is the use of a resource open, but also any derivatives created from the work must carry the same type of license. One example of an area in scholarship where copyleft licensing makes sense is open research data.

Intellectual property and copyright are areas that are rapidly evolving. There are two main thrusts for change: commodification of information, or the idea of seeking maximum profit; and liberation of information, seeing the potential of open sharing of information as the basis for advancing democracy, culture, and learning. To paraphrase Jean-Claude Gu  don, there is the knowledge economy, and the knowledge society.

Intellectual property and copyright have long been areas that librarians have been involved in. At the local level, ensuring compliance with copyright law is a traditional role for many librarians, and assisting authors with retaining their rights is an emerging role.

There are friends of open access among the publishing community, both open access publishers and subscription-based publishers who see OA as a desirable goal from a philosophical point of view and support OA to the extent that they believe they can. However, there are also those who seek maximum profit from intellectual property (whether commercial or not-for-profit publishers); they are very active in lobbying at national and international levels for laws favoring their interests. Some of the highly profitable publishing companies have ample means for lobbying. Librarians and others who advocate for the public interest in intellectual property must be active advocates in this area. Library associations are a key player in advocating for copyright laws that balance the rights of creators and users, at national and international levels.

One emerging issue in copyright law is the exemptions to copyright law currently enjoyed by libraries, through *fair use* or *fair dealing*, such as rights to interlibrary loan to other libraries. From the perspective of a company seeking only profit, there is no reason for interlibrary loan; it prevents a sale that, for the company, would mean even more profit. Librarians know that restricting interlibrary loan would generally simply mean loss of access, not profit for anyone. Active advocacy through our library associations is essential so that library patrons retain or increase rights, and do not lose existing rights.

The Western perspective does not include every concept of intellectual property that is worthy of consideration. One concept, from traditional knowledge in many parts of the world, is an idea that knowledge belongs to the world, of which we are a part. For example, a traditional medicine may

be seen as belonging to the plant itself, its environment, and the people who make use of the medicine. There is an obvious wisdom in this approach. Without the environment, the plant could not exist. Without the plant, the knowledge of the medicine specialist would be useless. As our understanding of intellectual property evolves, we would do well to listen to the voices of traditional knowledge, and consider developing our knowledge of intellectual property in a way that is informed by this ancient wisdom.

This holistic approach to understanding knowledge can easily be applied to scholarship. Every scholarly article builds on previous work. The scholar's ability is based on the scholar's education, an education often funded in part or in whole by society. Scholars are economically supported by universities, research organizations, and often funding agencies, and by their funders in turn, including taxpayers. Other scholars contribute to the work, including the voluntary peer reviewers, and often co-authors. When human subjects are involved, they too have contributed. Sometimes, the contribution of a human subject is minimal, as when first-year undergraduate students participate in a brief study to obtain credit. At other times, patients participate in medical studies, not knowing if they are receiving a drug or a placebo. The patient / subject may be hoping for benefits, but is also taking the risk that they will be the first to encounter a side-effect. Journals and publishers contribute too. In other words, there are many contributors to the creation of a scholarly article, besides the author. Yet the contributions of the authors, the scholars who often work long hours in a manner that seems as much avocation as vocation, is still the most substantial contribution to any individual work.

Open Access

As expressed by Peter Suber, in his *Open Access Overview*, “**Open access is literature that is digital, online, free of charge, and free of most copyright and licensing restrictions**”. There are three major definitional statements about open access, the *Budapest Open Access Initiative*, the *Bethesda Statement on Open Access Publishing*, and the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities*, collectively known as the BBB definition of open access. Each of these statements contains a significant *commitment* to open access, in addition to the definitions. There are other international statements of equal or greater significance in terms of commitment, including the Bangalore and Brisbane declarations, however these latter statements are not definitional in nature.

There are two main ways of providing open access, open access archives (also called the green road), and open access journals (also called the gold road). These are compatible. An article can be published in an open access journal, and also self-archived in an open access archive.

There are two kinds of open access, **gratis** or free to read, and **libre**, or free to read and free to reuse. The concept of open access can apply to a work (an article can be open access), or a process (publishing or archiving can be open access).

In these transitional times, there are many forms of expanded access. Many subscription-based journals provide **free access to back issues**. Once an article in such a journal becomes freely available, it can be said to be open access, while the journal itself is not an open access journal. There are hybrid journals, in which some articles are open access, and others are not. Open access can be seen as a continuum, with a subscription journal with no free access or author self-archiving allowed at one end, and the fully open access journal with libre re-use rights at the other end. The vast majority of journals and publishers are currently somewhere in the middle.

There are many benefits of open access. The primary benefit is expanded access, to researchers everywhere and others, including the public. In the developed world, open access expands access beyond the university, to the university's own alumni, professionals, high school teachers, government staff including staff at research funding agencies, local businesses, and the general public. Even the largest research libraries do not subscribe to every journal. Although access per se is not an issue here due to interlibrary loan, a researcher should make their work

open access to enhance the *visibility* of their work at even the largest research university. The difference in access is particularly noticeable in the developing world. Downloads from about 60 BioRxiv International open access journals reached 2.5 million in 2006.

Expanding access means acceleration of research, advancing our knowledge and more rapidly developing solutions to problems. Open access brings people together from around the globe; as expressed in the Budapest Open Access Initiative, "*Removing access barriers to this literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge*". For authors, there is a well-documented citation impact advantage, that is, articles that are open access are more likely to be read and cited.

Open access archives

The *Open Access Archives (OAI)* initiative is based on the premise that items and metadata can be deposited in a distributed way, with metadata harvested through the OAI-Protocol for Metadata Harvesting (OAI-PMH) standard for aggregation and cross-searching.

Open access archives can be institutional, or disciplinary. The largest open access archive is *PubMedCentral (PMC)*, an initiative of the U.S. National Library of Medicine (NLM), with over a million items. PMC provides both access and preservation, bringing forward the traditional role of the NLM in preserving the medical literature into the online environment. There are plans to expand PMC internationally. Already, a UK-PMC is operational, and discussions are underway with many countries to develop local versions of PMC, to both act as mirror sites and local collection archives.

arXiv, the physics server, is the second-largest archive, and heavily used by the physics community. There are 18 mirror sites, and over half a million hits per day on the main server hosted by Cornell University Library are not unusual. Some physics publishers accept submissions in the form of preprints on arXiv, and host their own mirror sites.

RePEC, research papers in economics, is a distributed set of archives, run by a global collaboration of volunteers. Not all items in RePEC are full-text.

E-LIS, the largest open access archive for library and information studies, is hosted by the CILEA group in Italy, and run by an international team of volunteer editors.

There are more than 1,200 open access archives listed in *OpenDOAR*, a vetted list of open access archives. Most of these are institutional repositories (IR). An Association of Research Libraries study in 2006 showed that the vast majority of member libraries expected to have an operational IR by the end of 2007. A search for the largest repositories in OpenDOAR quickly reveals the global reach and wide variety of institutional archives, from UCLA's *Archive of American Popular Music* to the numerous items from datasets on small molecules in *DSpace@Cambridge* to the research output of the National University of Taiwan in its repository.

There are many ways of cross-searching items in different repositories, such as the *OAIster* union catalogue hosted by the University of Michigan, and *Scientific Commons*.

Commonly used repository software includes D-Space, E-Prints, and Fedora. *SWORD* is a protocol to automate deposit into repositories; one use is to facilitate cross depositing from one repository to another. DSpace and E-Prints feature built in support for author self archiving and the OAI-PMH.

As institutional repositories are relatively new, key issues for librarians are education, promotion, content recruitment, copyright / author's rights, and open access policy. Sometimes, cross-

depositing in more than repository is seen as an issue, but it should not be; it is advantageous to deposit in as many repositories as possible, for preservation purposes.

Open access journals

There are many open access publishers, some larger and/or more well-known than others. Public Library of Science (PLOS), with about 7 journals, is a high-profile not-for-profit open access publisher aiming to compete at the high end of the scholarly publishing market, with subscription journals such as *Science* and *Nature*. PLOS began as an advocacy effort, then evolved into its current role as publisher. BioMedCentral (BMC) is a for-profit commercial open access publisher, recently acquired by Springer, with over 180 journals. Hindawi Publishing is a profitable for-profit open access publisher. PLOS, BMC, and Hindawi are all unusual for open access publishers, in that they follow an article processing fee business model. This business model is sometimes called “author pays”, which is misleading as the fees are generally paid by research funders, university departments, or libraries, not by authors. Article processing fees is a more accurate term. India’s Medknow Publications, with 73 journals, is a more typical open access publisher in that Medknow does not charge article processing fees.

Studies have shown that the majority of open access journals do not charge article processing charges. Open access journals are *less* likely to have publication charges than traditional subscription journals with traditional page charges.

As we saw in the section on publishers, there are many thousands of publishers, most publishing only one to three journals. To gather a snapshot of these more typical publishers, the author looked at the open access and hybrid journals listed in the Directory of Open Access Journals under Environmental Science. Of the 75 open access and hybrid journals, only 28 (37%) charged publication fees. The global reach of the open access movement is clearly revealed by the fully open access journals; 67 journals published in 27 different countries. English is the predominant language, but many other languages are represented. Most of the journals in this section are new; this is not surprising, given the topic. The oldest journal is *Current Science*, with a first publication date of 1932. The largest open access publisher in this group, Copernicus Publishing, has an interesting approach to article processing fees, with different fees for authors depending on the format of submission, whether or not they have followed the technical requirements, and whether they want Copernicus to do the copyediting, or make arrangements for this themselves. In other words, there is much that authors can do to keep costs down. One research funder, the Max Planck Society, covers the cost of publishing for its researchers; the full cost is covered if the author takes advantage of the discounts for submitting in proper format, or the author can decide to do less work, and cover the difference in cost.

Open access policy

Around the world, research funding agencies and universities have been developing and implementing policies requiring or mandating open access. There are over 50 open access policies, in many countries around the world, and many more to come. Medical research funding agencies have been among the first to adopt open access policies. The U.S. National Institutes of Health, the world’s largest medical research funder with a research portfolio of more than \$29 billion U.S. annually, was an early leader with their *Public Access Policy* of 2004, strengthened from a request to a requirement in 2008. The Wellcome Trust, a private charity in the U.K., was an early leader with a strong policy requiring open access to funded research within 6 months of publication. The U.K. Research Councils agreed to develop policies requiring open access to their funded research, and 6 of 7 now have policies in place. The Queensland University of Technology in Australia was the first to institute a university-wide open access policy. The Harvard Faculty of Arts and Sciences was the first to develop a faculty-led policy, in which faculty unanimously granted to Harvard a worldwide nonexclusive license to disseminate their work through a Harvard open access repository, “but not for a profit”. Watch for many more developments; for example, the European University Association, a body of more than 700

universities in over 40 countries, unanimously agreed to develop open access policies at each of their universities.

Early policy developments have provided some important lessons for others considering developing open access policy. **The experience of the NIH shows the importance of making open access a requirement, not a request.** Compliance with the voluntary policy was dismal, only 4% in the first year. Strengthening the policy to a requirement has already shown a significant increase in deposits, and U.S. universities, faculty and libraries are obviously working very hard towards full compliance.

Open access policies are invariably green policies, allowing authors the choice of complying through open access publishing, or in a traditional subscription journal and archiving for open access. Green is more inclusive, in that an open access journal will permit authors to self-archive in an open access archive as well. It is the author's final manuscript, following peer-review that is required for open access, not the publisher's final PDF.

A good policy specifies **immediate deposit, but may allow for delayed release.** This facilitates compliance, because researchers are much more likely to have the final manuscript at their fingertips at the time of publication, than after a delay period. A delay or **embargo period should be kept to a minimum,** and policies should specify review with a view to shortening or eliminating the embargo. A six-month maximum embargo period appears to be emerging as an international standard.

There is a powerful and wealthy anti-open-access lobby. It is very important for librarians to be aware of this lobby, and their tactics. These tactics sometimes include deliberate misinformation, such as the ludicrous argument that open access means government censorship, or the claim that open access is not compatible with peer review. The latter claim is completely inaccurate, as illustrated by the thousands of peer-reviewed fully open access journals listed in the Directory of Open Access Journals, the hybrid open access options offered by most traditional scholarly journals, and the self-archiving option for open access supported by a large majority of scholarly journals.

In spite of this lobby, the growth of open access is nothing short of phenomenal. Every day, on average, the Directory of Open Access Journals adds more than 2 new titles. In the third quarter of 2008, Scientific Commons, a service for cross-searching open access archives, grew by more than 3 million items.

The Economics of Scholarly Publishing

While scholarship and scholarly publishing can be a purely voluntary labor of love, it is also a business estimated at about \$5 billion US per year. The primary source of these billions of dollars is academic library budgets, with small contributions from other sources such as other subscriptions and advertising. The budgets of academic libraries already provide more than enough to fund a fully open access scholarly publishing system.

The serials budget is not the only potential source of support for scholarly communication in the library. Consider interlibrary loans, and the institutional repository. Once an article is deposited in the IR for open access, it no longer needs to be interlibrary loaned to anyone. As open access increases, staff time should be freed up in interlibrary loans, providing a potential source of needed staffing support for the institutional repository.

There are thousands of scholarly publishers, ranging from the very small to the very large, and there are huge differences in costs of publishing, not always related to quality. A small, not-for-profit society can often publish at a small fraction of the cost of a large, for-profit commercial publisher. A healthy, affordable scholarly publishing system needs these small, independent journals. This is why libraries are providing hosting and support services for open access and

alternative journals. Library publishing is an affordable alternative to commercial publishing services, a means for these journals to go online with the latest technology while still remaining independent.

One approach to an affordable scholarly communication system is educating faculty about the costs involved in scholarly publishing, and the wide differential between similar journals. Ted Bergstrom and Preston McAfee in 2005 developed a Journal Cost-Effectiveness Tool. As noted earlier, the subscription cost per article for similar journals can be 30-fold or more; this tool makes it possible to compare costs of individual journals within a particular field. The Journal Cost-Effectiveness Tool is dated, and this approach is limited by the fact that many journals are now only sold in bundles. The subscription price for a journal in print is not necessarily relevant, and the cost for an individual title in an electronic bundle of journals may be impossible to determine, except on an average basis.

An emerging measure of affordability that will likely soon replace cost per subscription is **cost per article**. The cost of producing a scholarly journal article has been estimated to be in the range of nothing to \$20,000 per article. This makes sense, because there are many elements to producing a journal article, all of which can be done either through volunteer efforts and in-kind support, or paid staff, overhead, profit, etc., at varying rates. The Wellcome Trust did a thorough study a few years ago, and estimated the necessary costs of production of an open access, electronic-only article at about \$1,500 per article for a high-quality journal, and about \$750 per article for a medium-quality journal. This measure is important; it is the average cost per article, whether paid for through subsidizing journals or article processing fees that will determine the affordability of open access publishing.

For a fully open access journal, the criterion of cost per article as a measure of affordability is relatively simple to understand and apply. With hybrid subscription / open access journals, **libraries need to be on the lookout for double dipping**, that is, publishers continuing to receive the same subscriptions revenue, while pocketing additional revenue from open access fees. Oxford University Press has a *good* model; they are already adjusting subscription fees, in some cases decreasing the fees, to reflect open access article fee revenue, and they also recognize contributions from subscriptions, by offering authors from subscribing institutions lower fees for open access articles. When negotiating either subscriptions or open access, libraries need to ensure that pricing reflects that publishers are receiving revenue from both sources. The Oxford open access option is *libre* open access. Not every “open access” hybrid option is really open access at all; some such options are worth supporting, others are not.

Librarians can **seek support for open access in licensing** and procurement practices, for example by requesting authors' rights when signing purchase agreements.

There is a role for library consortia in supporting open access and alternative publishing. The International Coalition of Library Consortia (ICOLC) 2004 update to the *Statement of Current Perspective and Preferred Practices for Selection and Purchase of Electronic Information* calls for everyone involved in scholarly publishing to be involved in the development of alternatives, including experiments with open access. ICOLC partnered with others to develop a plan for sustainable open access for the *Stanford Encyclopedia of Philosophy*. The Canadian Research Knowledge Network (CRKN) in 2008 committed to “negotiate aggressively for reduced licensing fees for content resources that have open choice (i.e. author pay) provisions”, in the CRKN *Statement on Alternative Publishing Models & Open Access*.

The kinds of support needed by scholarly communication will be very different in the future from purchasing subscriptions, collecting, storing, and preserving print. New types of resources will be needed; storage space and infrastructure for collecting and sharing large quantities of data; collections of electronic information that will often involve linking between resources, and/or multimedia formats, and a shift to supporting the *production* of scholarly publishing, not just purchase of its outputs. This means a rethinking of the library's purpose and mission, crafting

new collections policies that reflect this shift, and planning for the redeployment of resources. This will take time (years, and decades), and changes will happen at different paces in different libraries.

Emerging Trends

The advent of the Internet is an event with an historical significance as least as great as that of the printing press. We cannot yet foresee its full potential, and scholarly communication has only just begun to explore the possibilities, but already there are portents of what is to come.

Journals are beginning to evolve, and that is a good thing. Boundaries are beginning to disappear. As libraries work in the areas of both open access archives and open access journals, a journal may be housed in an archive. A pilot project on an overlay journal concept, building a review process on the arXiv preprints process, is underway. The *Journal of Visualized Experiments* mentioned earlier is a journal in audiovisual format. *iForest* is publishing articles as soon as they are ready, not waiting to bundle them into issues.

Open access is only one of many inter-related open movements, along with open monographs, open textbooks, open education, and open data.

Research data can now be published and reused, ranging from the huge datasets associated with projects such as the Large Hadron Collider, to a simple spreadsheet posted to the web for anyone to download and manipulate. Google Earth has made it possible for researchers to discover that cows and deer tend to align themselves north to south. Libraries are partnering with Google or the Open Content Alliance to place millions of books online.

The world's history is literally coming alive and online, thanks to digitization efforts around the world, from the *Dead Sea Scrolls* to *Multicultural Canada*. Digitization of primary sources in other fields such as literature is opening up new avenues for research.

Social software is having an impact on scholarship. Scholars are creating new knowledge by mashing up datasets, blogging, wikis, and attending unconferences such as Sci Foo Camp.

What can librarians do to prepare for the future?

- learn about one or more emerging trends and formats
- get involved in research-related initiatives on campus
- think about what our skills are, and how they apply in an online future
- learn about preserving digital information
- learn about technical standards for metadata, and to allow for interoperability
- administrators: commit resources to the future, including long-term preservation of digital information

Conclusions

It is an exciting time to be a librarian. After decades of a scholarly communication system in crisis, technology has evolved to the point where new opportunities are creating the potential for change, not only to fix our current system of scholarly communication, but to create one that can do a great deal more. It is a time when librarians can begin to develop deeper relationships with faculty; to talk with faculty not just about what they would like to read, but about their research; not just about complying with copyright, but about retaining their rights so that faculty (and everyone, everywhere) can use scholarly resources in new ways, opening up whole new avenues for research and discovery. Our world is at a crossroads; the Internet can profoundly affect the future of the world, and it matters a great deal whether we see this as an opportunity for liberating knowledge and sharing with humankind, or let a narrow-minded view of information purely as commodity prevail. Librarians and others with an understanding of the public interest need to

advocate for things like balanced copyright legislation. We need to understand libraries as a primary support for scholarly communication, and prepare to shift from purchasing collections, to producing them. New ways of doing research based on what our technology makes possible are on the horizon. It is time to rethink what the library is, and prepare for a future of open data, big data, journals that are no longer journals, research based on social software, scholarly un conferences – and who knows what else.