

# Does Open Access Really Make Sense? A Closer Look at Chemistry, Economics, and Mathematics

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This article briefly reviews concepts and models associated with open access publishing. It provides a set of data about the frequency of public funding support for research published in leading journals in the disciplines of Chemistry, Economics, and Mathematics. Funding differences by discipline are highlighted. The authors' intent is not to draw broad conclusions but simply to inform the wider discussion of open access.



The increasing cost of scholarly publications, combined with the evolution of the Internet and the growing sophistication of search engines, has encouraged a call for journals to move to an "open access" model. In the basic model for open access publication, content is provided free on the open Internet as a replacement for the current subscription model. Currently, according to Van Orsdel and Born (2005), the publication and distribution costs of academic journals are primarily covered through subscription fees that range between a \$799 and \$2,868 average cost per title for various scientific disciplines.<sup>1</sup> Under the most common alternative open access model, the costs of publication are derived from publication fees received from authors. McCabe and Snyder (2004) report that many online journals such as *PloS Biology* charge fees as high as \$1,500 per accepted article.<sup>2</sup>

Stern (2005) explores many of the alternative models of open access jour-

nal pricing. BioMed Central charges no author fees to authors from member institutions. Authors from nonmember institutions pay an article processing fee of \$500. He also discusses the option of differential pricing, in which schools would pay a graduated fee based on either level of access or the types of services they demand. This model appears to be a midpoint between current subscription-based journals, where the entire costs are borne by the publisher and subscribing libraries, and open access, where the costs are borne by the authors.<sup>3</sup> In addition to Stern, a number of studies have concentrated on the cost of both traditional paper journal publishing and electronic journals; see, for example, Willinski (2003),<sup>4</sup> Bot, Burgemeester and Roes (1998),<sup>5</sup> King and Tenopir (1998),<sup>6</sup> Odlyzko (1997),<sup>7</sup> Fisher (1997),<sup>8</sup> Guthrie (1997),<sup>9</sup> and Odlyzko (1994).<sup>10</sup>

While there are many models, the primary effect of moving to open access is that articles only previously available

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through subscription will now be available to a larger audience through open Web access, and individuals would not be required to obtain (or have their institutions obtain) licenses for each journal they are interested in reviewing.

Why move to open access? One argument is that the movement to open access makes new research quickly available to a wider audience, thus increasing its impact. Harnad and Brody (2004) examine the impact of open access journals by looking at the differing citation rates between the articles in a traditional journal that were also available through open access with those in the journal that were not available through such means. They report that, in the physics discipline between 1992 and 2001, the ratio of open access to non-open access citations was between 2.5:1 and 5.8:1. Harnad and Brody also point out that open access allows a greater number of individuals access to journals that many libraries previously

could not afford. The metric they report to measure this is the ratio of "reads" to citations in open access journals. They report that other researchers (Kurtz 2004, in particular) have found ratios of 12:1 and 17:1 for open access journals.<sup>11,12</sup>

A second argument for open access is that those who sponsor the research should have ownership of the results. In his article "Open Access in the Real World," Rick Anderson asks an important question: if funding for academic research is provided publicly through government grants or through public universities, should the information pass immediately to the public domain—should it be readily available through open access?<sup>13</sup> This is a complicated question since, even in government supported research, there are many costs involved in publication that are borne by the entities involved in the creation and dissemination of research. There are, for instance, the costs of production of the research (facilities, collect-

**TABLE 1**  
**Journals Examined**

<b>Name of Journal</b>	<b>Years</b>	<b>Frequency of Publishing</b>
<b>Economics Journals</b>		
<i>Journal of Economic Perspectives</i>	1999–2004	Quarterly
<i>Journal of Economic Literature</i>	1999–2004	Quarterly
<i>Quarterly Journal of Economics</i>	1999–2004	Quarterly
<i>Brookings Papers on Economic Activity</i>	1999–2004	Semi-Annually
<i>Journal of Political Economy</i>	1999–2004	Every 2 Months
<b>Chemistry Journals</b>		
<i>Chemical Reviews</i>	2000–2005	Monthly
<i>Accounts of Chemical Research</i>	2000–2005	Monthly
<i>Journal of the American Chemical Society</i>	2004–2005	Weekly
<b>Mathematics Journals</b>		
<i>Bulletin of the American Mathematical Society</i>	1999–2004	Quarterly
<i>Acta Mathematica Sinica</i>	2000–2004	Monthly
<i>J. Amer. Math. Soc.</i>	1999–2004	Quarterly
<i>Comm. Pure Applied Math.</i>	1999–2004	Monthly
<i>Inventiones Mathematica</i>	1999–2003	Monthly

**TABLE 2**  
**Funding Count and Percentages by Journal and Area**

	Total Articles	% Funded Publicly	% Funded Privately
<b>Chemistry Journals</b>			
<i>Chemical Reviews</i>	857	58	19
<i>Accounts of Chemical Research</i>	585	73	23
<i>Journal of the American Chemical Society</i>	4,675	57	21
<i>Total/Weighted Average</i>	6,117	59%	22%
<b>Economics Journals</b>			
<i>Journal of Economic Perspectives</i>	332	15	17
<i>Journal of Economic Literature</i>	109	21	18
<i>Quarterly Journal of Economics</i>	236	50	42
<i>Brookings Papers on Economic Activity</i>	78	14	14
<i>Journal of Political Economy</i>	317	40	33
<i>Total/Weighted Average</i>	1,072	31%	32%
<b>Mathematics Journals</b>			
<i>Bulletin of the American Mathematical Society</i>	259	14	4
<i>Acta Mathematica Sinica</i>	361	83	19
<i>J. Amer. Math. Soc.</i>	253	67	23
<i>Comm. Pure Applied Math.</i>	298	63	21
<i>Inventiones Mathematica</i>	369	58	21
<i>Total/Weighted Average</i>	1,540	59%	18%

ing and analyzing the data, and so on) and the costs of distribution (for example, assembling the journals and making them available to readers).

Even if these costs are negligible, they must be paid by someone. Under the alternative mentioned above, those costs can be easily shifted to the authors of the article. This approach makes some sense, since the authors generally reap the most direct benefits of article creation in the form of career advancement (salaries, promotion, other funding opportunities, to name a few).

Once the costs of distribution are removed from consideration, the remaining issue for the second justification for open access publishing is "who paid for the research"? This article takes a closer look at the sources of funding for published research in the three disciplines of Econom-

ics, Mathematics, and Chemistry by examining the source of funding for articles appearing in some of the top journals over the past two to five years.<sup>14</sup> The research indicates that a majority of the funding in the areas of mathematics and chemistry is publicly provided and that there is less public support for the research published in economics journals.

Table 1 lists the journals we examined and their field dates of publication and publication frequency.

Table 2 shows that in the field of chemistry we examined 4,675 different articles. Out of those, approximately 3,600, or 59 percent, listed explicit sources of public funding for their research. Only 22 percent of the published articles listed private funding sources. In the field of economics we examined 1,072 articles between 1999 and 2004. Of those listing

external funding, the split was about even between public and private funding—31 percent publicly funded and 32 percent privately funded. In the field of mathematics we examined 1,540 articles from five journals covering 1999–2004. Of those articles, 59 percent reported public funding, while only 18 percent reported private funding.

### Conclusion

Again, we do not intend to draw broad conclusions from this investigation; the research was intended simply to provide a piece of data for the ongoing discussion. It is evident, however, that open

access publishing is still establishing a clear identity and its models and methods are diverse. Increased readership, faster dissemination, and more elaborate, data-filled articles are only a few of the reasons for the interest in the approach. The case made that publicly funded research needs to be fully accessible is, at least intuitively, one of the most satisfying arguments. Clearly there is considerable public funding supporting the research published in the journals we examined. Even in our lowest publicly supported field, economics, nearly one third of the published research articles acknowledged public funding.

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### Notes

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14. The length of time varies based on the frequency of publication. For example, we use two years of data from the *Journal of the American Chemical Society*, which is published weekly (over 1,000 articles per year), and five years of data from the *Journal of Political Economy*, which is published bimonthly (about 300 articles per year)

15. Note that totals may exceed 100 percent, as some authors report multiple sources of funding (both public and private).

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