“Local Evaluation of Chemistry Journals”

Joseph Kraus (corresponding author)

Science and Engineering Librarian

Penrose Library

University of Denver

2150 E. Evans Ave.

Denver, CO 80208

joseph.kraus@du.edu

Rachel Hansen

Morgridge College of Education, Library and Information Science Program

University of Denver

rhansen3@du.edu

Abstract

This paper reports on the evaluation of local usage statistics of a specific set of chemistry journals at the University of Denver in Colorado, USA. The objective of the study is to demonstrate that commercial publishers in chemistry charge considerably more for their journals than those from the non-commercial sector. There are three variables that are considered in this research: institutional cost of the journal, cost per Thomson Scientific Impact Factor (IF), and

cost per article downloaded. In the defined set of 65 journals, it is found that commercial publishers charge more for their journals by a ratio of 2.59. Commercial publishers cost more per impact factor by a ratio of 3.20 and significantly more per local article download by a ratio of 6.16. This research demonstrates that local usage statistics should be used as part of the journal evaluation process.

Keywords: chemistry journals, usage statistics, information use

Introduction

The evaluation of journal usage statistics is nothing new. In the print age, libraries kept track of the volumes that were pulled from periodical shelves (Hill 1999), and starting in the 1990's, many libraries kept track of online journal usage. (Burgard 1999; Nisonger 2001) The findings from Gooden (2001), Vallmitjana and Sabaté (2008) and Chrzastowski and Olesko (1997) are particularly relevant since they evaluated how chemists use the journal literature.

Academic libraries have gone through a great number of changes over the last 30 years. Many institutions ramped up their subscriptions to scientific journals in the 1970's when scientific output was being increased. At the time, most of the scientific journals were published by nonprofit societies and presses. But, with the increasing need for authors to get published, commercial presses arrived on the scene to provide more publishing options. From the 1980's through the present, publishers increased their subscription prices for a number of reasons, and this created the "serials crisis" in academic libraries. (Miller 2000; Greco 2006)

While the "Open Access" movement is seen as a response to the serials crisis and a positive publishing option in many scientific fields, there is some resistance to open access publishing within the chemistry community. (Michaelson 2008) Many chemists are the concerned with the viability of the business models and the long term maintenance of the archives. (Casey 2004) The American Chemical Society (ACS) does allow authors to pay for open access to their articles, from $1,000-3,000 depending upon his or her affiliation to the ACS.^ However, they do

not allow for pre- or post-print institutional archiving of their articles, unless mandated by a funding organization.* The Faculty of Arts and Sciences at Harvard University passed a policy in 2008 that mandates open access to the faculty members' research publications. (Rovner 2008) The NIH has also mandated a "Public Access Policy" for scholarly work that was funded by the agency. The American Chemical Society responded to the NIH policy by letting authors know how they can meet the new open access requirements on their Website.^^

Many commercial publishers do allow for pre- and/or post-print archiving of their articles in institutional repositories. For example, Elsevier allows authors to archive their pre- or post-print refereed articles in a local repository. Researchers have documented that articles available through open access have higher citation rates. (Eysenbach 2006; Harnad & Brody 2004) Perneger (2004) also noted a positive correlation between the number of articles downloaded and citation rates. For more on the principles of open access, two books by Jacobs (2006) and Willinsky (2006) provide plenty of background on the topic.

The cost of chemistry journals is documented to be the highest in all of the academic disciplines. (Van Orsdel and Born 2007) In 2007, the average price of a chemistry journal was $3,429 for institutions. They also found average journal prices in other scientific fields, such as: physics ($2,865), biology ($1,676), and the health sciences ($1,199). In 2007, the average cost of a journal title in the Thomson/ISI Science Citation index was $1,193.

Even though the cost of chemistry journals are very high, academic institutions still subscribe to many of them because chemical research is highly dependent upon the journal literature, thus

chemists are heavy users of libraries resources. (Flaxbart 2001) But, librarians are "beginning to ask hard questions about the relationship between the value of a journal and its price." (Van Orsdel & Born, page 48)

Current State

If a college or university in the United States would like to maintain an accredited program in chemistry education by the American Chemical Society (ACS), the academic library should follow the guidelines and requirements of the ACS Committee on Professional Training. (2008) The Committee recommends standards for the academic library to maintain certain journal subscriptions.

The authors present an evaluation of the local use of the 65 journals as provided by the committee.** Ten journals are marked as "general content", 18 titles are "highly recommended", and 37 titles are "also recommended". Of those 65 journals, 29 are published by commercial presses, and 36 are published by non-commercial publishers. See figures one and two.

Figure 1. Journals from non-commercial publishers.

Journal Title	Publisher
Accounts of Chemical Research	ACS
Analytical Chemistry	ACS
Applied Spectroscopy	Society of Applied Spectroscopy
Biochemistry	ACS

Bioconjugate Chemistry	ACS
Canadian Journal of Chemistry	National Research Council of Canada
Chemical Communications	RSC
Chemical Reviews	ACS
Chemical Society Reviews	RSC
Chemistry Letters (Japan)	Chemical Society of Japan
Chemistry of Materials	ACS
Dalton Transactions	RSC
Environmental Science & Technology	ACS
Faraday Discussions	RSC
Industrial & Engineering Chemistry Research	ACS
Inorganic Chemistry	ACS
Journal of Biological Chemistry	American Society for Biochemistry and Molecular Biology
Journal of Chemical Education	ACS, Section of Chemical Education
Journal of Chemical Information and Modeling	ACS
Journal of Chemical Physics	AIP
Journal of Chemical Theory and Computation	ACS
Journal of Medicinal Chemistry	ACS

Journal of Organic Chemistry	ACS
Journal of Physical Chemistry A	ACS
Journal of Physical Chemistry B	ACS
Journal of the American Chemical Society	ACS
Langmuir	ACS
Macromolecules	ACS
New Journal of Chemistry	RSC
Organic and Biomolecular Chemistry (formerly Perkin Transactions 1 and 2)	RSC
Organic Letters	ACS
Organometallics	ACS
Physical Chemistry Chemical Physics	RSC
Proceedings of the National Academy of Sciences	NAS
Pure and Applied Chemistry	IUPAC (International Union of Pure and Applied Chemistry)
Science	AAAS

Figure 2. Journals from Commercial Publishers

Angewandte Chemie International Edition	John Wiley
Biochemical Journal	Portland Press Ltd.

Bioorganic Chemistry	Academic Press/Elsevier
Chemical Physics Letters	North Holland/Elsevier
Chemistry - A European Journal	John Wiley
Chemistry and Biology	Cell Press/Elsevier
European Journal of Biochemistry (Now called FEBS Journal)	Blackwell Publishing
European Journal of Inorganic Chemistry	John Wiley
European Journal of Organic Chemistry	John Wiley
Helvetica Chimica Acta	John Wiley
Inorganica Chimica Acta	Elsevier
Journal of Biological Inorganic Chemistry	Springer
Journal of Catalysis	Academic Press/Elsevier
Journal of Chromatography A	Elsevier
Journal of Chromatography B	Elsevier
Journal of Coordination Chemistry	Taylor and Francis
Journal of Electroanalytical Chemistry	Elsevier
Journal of Molecular Biology	Academic Press
Journal of Organometallic Chemistry	Elsevier
Journal of Polymer Science Part A-polymer Chemistry	John Wiley
Journal of Polymer Science Part B-Polymer Physics	John Wiley
Magnetic Resonance in Chemistry	John Wiley

Nature	Nature Publishing Group
Nature -structural and molecular biology (2004)(formerly Nature - Structural Biology)	Nature Publishing Group
Spectrochimica Acta A	Elsevier
Spectrochimica Acta B	Elsevier
Tetrahedron	Elsevier
Tetrahedron Letters	Elsevier
Trends in Biochemical Sciences	Elsevier

The Committee wrote that "the onsite collection must include no fewer than 14 journals chosen from the CPT journal list. Of the 14, at least 4 must be from the general content list, and there must be at least 1 from each of the following areas: analytical, biological, inorganic, organic, and physical chemistry." (Committee on Professional Training 2008, p. 7) The library must subscribe to at least one of those journals in each subject area regardless of the price or the publisher of the journal. So, if a journal is on the list of 65 journals, the committee declares it to be high enough quality.

The authors evaluated several variables concerning those journals. While there are numerous ways to evaluate the costs of journals, such as the cost per citation, cost per issue, cost per article, cost per page (Association of Research Libraries 1999), or even the cost per character (Barschall 1988), we focused on four other variables. They were cost per institutional journal subscription, cost per impact factor, cost per article download, and the type of journal (commercial vs non-commercial).

Methodology

Impact Factors

The Impact Factor is a number published by Thomson Scientific in their *Journal Citation Reports*. We used the most recent data from 2006 published in 2007.*** Responsible use of the impact factor is widely debated. (Rossner et a. 2008; PLoS Medicine Editors 2006) For more information, Eugene Garfield (the person who developed the Science Citation Index and the impact factor) covers the history of the impact factor (2006) and proper use of the data (1994). In academic libraries, the IF is just one of the factors used for evaluating journals, but it is by no means the only measure that is used. Some of the other variables librarians use include the relevance of the journal's subject area to the university, reputation of the publisher and the editorial board, recommendations from teaching faculty, download statistics, interlibrary loan statistics, citation statistics and more.

It should be noted that the Impact Factor is an evaluation of the recent use of a journal. The IF number does not indicate the importance of the historical literature within a particular journal. Impact factors can also vary greatly from one subject area to another. In the "analytical chemistry" area, a journal with an impact factor of 3.0 would put it at 9 out of 68 journals, while another journal with the same Impact Factor in the "biochemistry and molecular biology" subject area would have a rank of 102 out of 262 journals.

Local Usage Statistics

Philip Davis (2002) noted that

> "despite their wide use and appeal, Impact Factors tell you nothing about the local use of journals. In essence, they report the citation patterns of hundreds of thousands of articles published annually by the entire scientific community."

In order to learn more about the local usage of these chemistry journals, statistics concerning the number of article downloads were gathered from the various publishers. Statistics were gathered from publishers who provided article download statistics from the University of Denver patrons over a 2.5 year time frame, from January 2005 through the middle of 2007. We were able to get usage statistics for 59 of the 65 journal set; 33 were non-commercial and 26 were from commercial publishers.

The temporal depth of content can vary a great deal from one publisher to another. For example, our patrons can download articles from over a 100 year span of the *Journal of the American Chemical Society* since we have the ACS archive going back to 1879. The same is true for chemistry journals from Elsevier, since we purchased the chemistry backfile set. With journals from the RSC and John Wiley, the university provided online access to their journals going back about 10 years, so the number of downloads from those publishers may be reduced when compared to other publishers. Vallmitjana and Sabaté (2008) found that most chemistry research cited by Ph.D. students were published within the last 14 years. However, Hallmark (2004)

found that some chemists download a bit of archival literature as the older articles become available.

Journal Cost Data

The institutional cost of the journals were derived from either the journal website or from EBSCO, our serials vendor. For some journals, the online cost is considerably more expensive than an institutional print subscription, such as *Science* and *Nature*. The site-wide online subscription prices are used in those cases. We did not factor in the cost of journal backfiles that were purchased using one-time funds.

We have print access to the journal *Nature Structural and Molecular Biology*, so we do not have any publisher based download statistics for that specific journal. We do not have a current subscription to the *Biochemical Journal*. We were not able to retrieve download statistics for a small number of other journals. They were the *Journal of Chemical Education*, *Chemistry Letters*, *Journal of Coordination Chemistry*, and *Pure and Applied Chemistry*.

Results

Several years ago, Joseph Kraus (2004) presented a poster paper at the AAAS Southwestern and Rocky Mountain Division meeting. He evaluated most of those chemistry journals for cost per cited use, but the online use data was incomplete since the University of Denver had limited online access to many of those journals. At the time, the library received online usage statistics

from only 20 of the 61 journals from the 2003 CPT list. Since then, the library greatly increased online access to more current chemistry journals, 63 out of 65. In 2007, we were able to get online usage statistics from 59 of the 65 journals from the 2005 CPT list. We were able to get Impact Factors for all 65 journals.

The results of this research show that there is still a great discrepancy in cost between the commercial and non-commercial presses on a cost per journal, cost per downloaded article and cost per impact factor basis. Figures three through seven provide the results of the ratios for the variables. Figures eight and nine display a ranked order of the costs of the journals.

Figure 3. Institutional cost ratio of commercial to noncommercial journals

Non-commercial Journal Average Cost (36 titles)	$2,538.77
Commercial Journal Average Cost (29 titles)	$6,577.57
Institutional cost ratio of commercial to noncommercial journals	**2.59**

Figure 4. Ratio of commercial to non-commercial cost per IF

Non-commercial Journal Average cost per IF (36 titles)	$438.85
Commercial Journal Average	$1,405.07

cost per IF (29 titles)	
Ratio of commercial to non-commercial cost per IF	**3.20**

Figure 5. Average cost per download for non-commercial articles

Total Cost for the non-commercial journals (33 titles for 2007)	$88,550
Total number of non-commercial articles downloaded from January 2005-June 2007	26,187
Average number of non-commercial articles downloaded per year	10,474.8
Average cost per download for non-commercial articles	**$8.45**

Figure 6. Average cost per download for commercial articles

Total cost for the commercial journals (26 titles for 2007)	$175,721
Total number of commercial articles downloaded from	8433

January 2005-June 2007	
Average number of commercial articles downloaded per year	3373.2
Average cost per download for commercial articles	**$52.09**

Figure 7. Ratio of commercial to non-commercial cost per downloaded article.

Ratio of commercial to non-commercial cost per downloaded article	**6.16**

Figure 8. Cost of commercial journals in USD

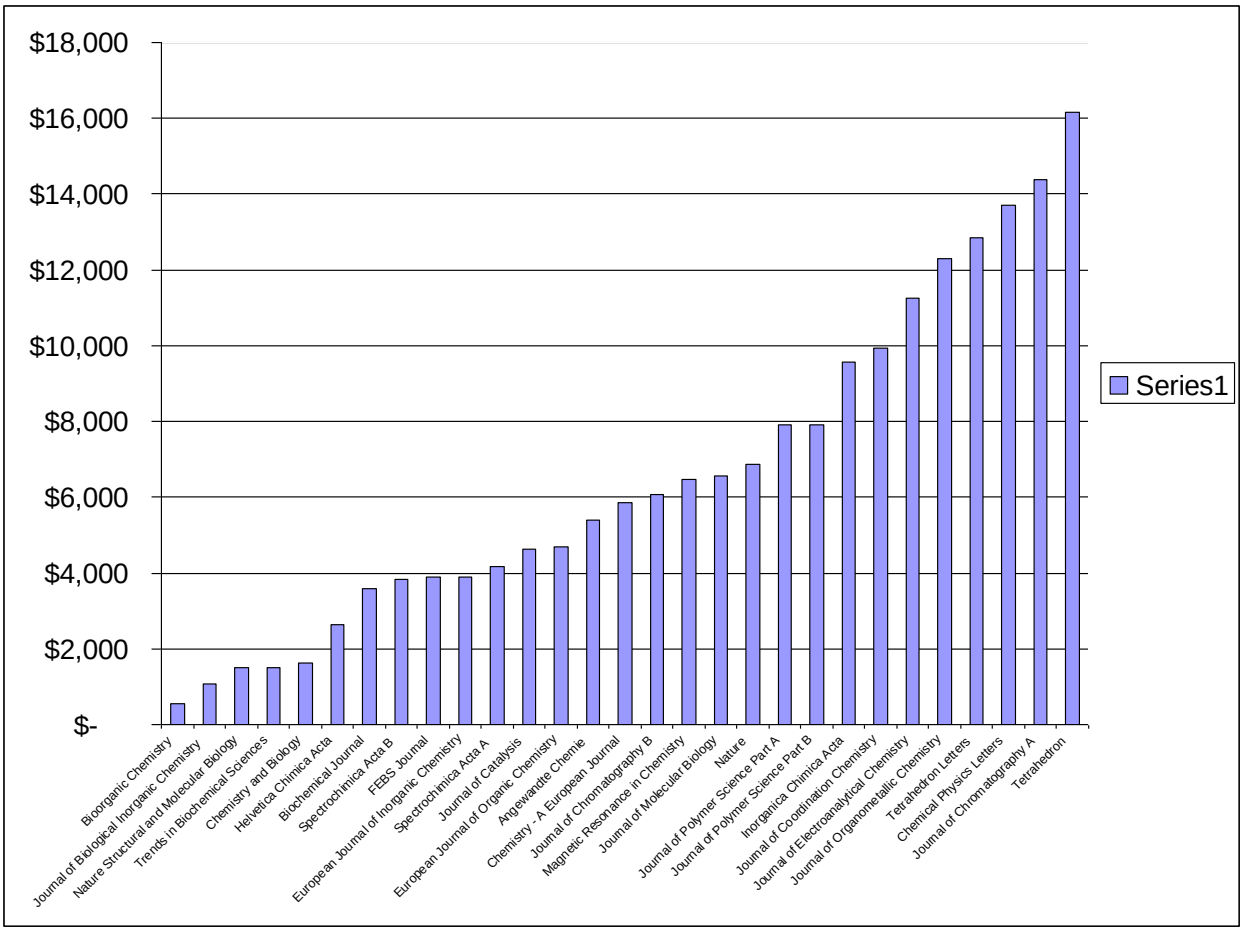
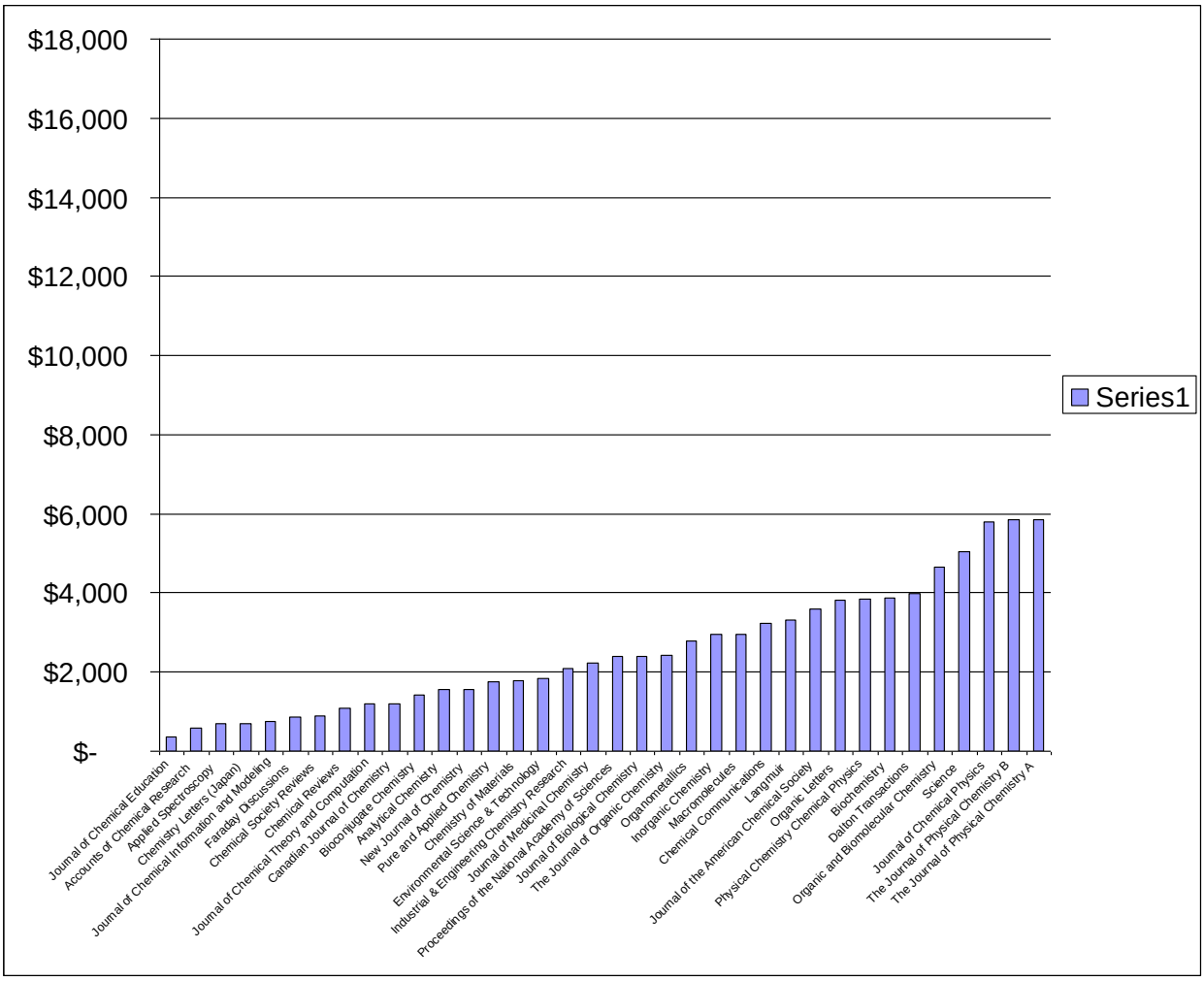


Figure 9. Cost of non-commercial journals in USD



Conclusions

Philip Davis (2002, page 157) noted that "whether measured as cost per title, cost per page, cost per character, or cost by impact factor,… journal price studies point speculatively at the comparatively high prices charged by commercial publishers." This article further supports this hypothesis.

What can libraries and their patrons do about the problem? We recommend to science faculty that they submit articles to non-commercial and open access sources first, and publish in commercial journals as a last resort. Even though many commercial presses let authors archive their articles in local repositories, that does not change the fact that libraries are charged a great deal to subscribe to their journals.

Casey (2004) noted that the solution to the serials crisis "will also require scientists to exert pressure on commercial publishers. The time has come for chemists who are editors or editorial board members of commercial journals to use their considerable influence to strongly urge publishers to greatly reduce their prices…. It is also time for chemists to consider whether they will continue to support exorbitantly priced commercial journals by serving as editors, editorial board members, authors, and referees!"

Even though it has been shown that commercial journals in chemistry have less "value" than non-commercial journals, libraries continue to subscribe to commercial journals because researchers need the specific sources of information. Each research journal article is unique; an article in a non-commercial journal cannot take the place of a similar article published in a commercial journal. Libraries continue to subscribe because patrons demand convenient access to the journal literature. The library could use interlibrary loan or document delivery services to request individual articles, but that adds a substantial barrier to the use of the literature.

While the cost of the commercial journals are high, we are not in a position to cancel individual titles from many of the commercial publishers since we have package deals through a consortia.

We will continue to monitor the situation and evaluate alternatives to see if we can provide the same high level of service and article access at less cost.

Open access continues to be an avenue of interest for scientists and librarians. With this new data, we hope to convince more chemists to support institutional archives, open access principles and the non-commercial journal sector.

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Notes:

^ http://pubs.acs.org/pressrelease/author_choice/ (from $1,000-3,000 author pays model)

* See the RoMEO, publisher copyright policies & self-archiving database for more information (http://www.sherpa.ac.uk/romeo.php). The database indicates that the American Chemical Society has severe archival restrictions for authors.

Publisher: American Chemical Society

Pre-print: author cannot archive pre-print (ie pre-refereeing)

Post-print: author cannot archive post-print (ie final draft post-refereeing)

Conditions: The author may post on the web the title of the paper, abstract (no other text), tables and figures on their own web site

NIH funded authors may post articles to PubMed Central 12 months after publication.

The author may link to publisher version.

^^ See http://pubs.acs.org/paragonplus/copyright/nih/

** from http://portal.acs.org/portal/fileFetch/C/WPCP_008748/pdf/WPCP_008748.pdf. Note that the *Journal of Chromatography*, the *Journal of Polymer Science* and *Spectrochimica Acta* have two parts each, so those are actually six journals instead of three.

*** See this link (http://scientific.thomsonreuters.com/free/essays/journalcitationreports/impactfactor/) for a good explanation of the Impact Factor.