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COMMENTARY

The Changing Landscape of Scholarly Publishing: Will *Radiation Research* Survive?

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As a society published journal, *Radiation Research* has been a successful and enduring project of the Radiation Research Society (RRS). In 59 years of publication, the journal has produced 732 issues and 10,712 articles. As a nonprofit organization, RRS, like most societies, has used revenues from subscriptions to support, in part, the life of the organization (meetings, conferences and grants to new scholars). The model for scientific publishing, however, continues to evolve. *Radiation Research* has weathered the rise of electronic publishing, consolidation in the commercial publishing industry, the aggregation of library subscriptions and library subscription cuts. Recent years have seen dramatic changes in how scholarly publishing is financed and new funder and institution policies will accelerate these changes. The growth of open access to journal articles reflects the information habits of readers and facilitates the dissemination of new knowledge. The Radiation Research Society, however, will need to account for and adapt to changes in the publishing market if it intends to support the communication of peer reviewed scholarship in the future. © 2013 by Radiation Research Society

THE CHANGING LANDSCAPE OF SCHOLARLY PUBLISHING: WILL RADIATION RESEARCH SURVIVE?

As a society published journal, *Radiation Research* has been a successful and enduring project of RRS. In 59 years of publication, the journal has produced 732 issues and 10,712 articles. With over half a century of disseminating scientific discovery “in the study of the properties and effects of radiation,” (1) the journal provides a represen-

tative record of the progress of knowledge in its subject areas (2–5). In addition, the journal has proved to be a reliable financial asset for RRS. From 2007–2011 the journal produced a healthy 20% profit for the society (460,374/2,327,216).² As a nonprofit organization, RRS, like most societies (6), has used these revenues to support, in part, the life of the organization (meetings, conferences and grants to new scholars). The journal has produced these profits even during dramatic shifts in how scholarly communications are funded, produced and disseminated. In recent decades, *Radiation Research* has weathered the rise of electronic publishing, consolidation in the commercial publishing industry, aggregation of library subscriptions (a.k.a. the “Big Deal,” in which libraries purchase a large bundle of journal titles from a publisher without the ability to cancel under-used titles) and library subscription cuts. This record of success is a testimony to the creativity and devotion of RRS to its publication as well as to the quality of the science published in its pages. The market for scholarly publishing, however, continues to evolve. Recent years have seen dramatic changes in how scholarly publishing is financed and new funder and institution policies will accelerate these changes. If RRS hopes to continue to use the journal to “promote dissemination of knowledge,” (1) it will need to account for these changes and adapt in ways that position the journal for a bright future.

A VERY BRIEF LOOK AT THE LONG HISTORY OF SOCIETY-PUBLISHED JOURNALS

Societies such as RRS have long played an important role in the conduct, review and dissemination of science. In fact, the beginnings of scholarly journal publishing and peer review may be traced to the activities of one, well-known society, the Royal Society of London. By most accounts, the Royal Society is one of the first learned associations

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² IRS Form 990, 2007–2011; Guidestar.org.

devoted to scientific discovery. It was established in 1660 by King Charles II; in 1665, a mere five years later, the Royal Society's secretary, Henry Oldenburg launched the journal, *Philosophical Transactions* (7). More than an outlet for academic news and gossip, the Transactions were meant to prevent disputes about the origin of ideas while also providing a "universal" record of European scientific discovery (8). Lest our era seem unduly unique, it is worth noting that Oldenburg meant to solve an access problem (at the time, much of science was shared only in letters between individual scholars) while also taking advantage of new systems (only twenty years earlier, King Charles I had established an international postal service) (7). It is also worth noting that Oldenburg's venture was a financial flop. Oldenburg did most of the work at cost or for a loss. The Transactions ceased publication at his death in 1677 and did not resume until 1683 when a new secretary, Robert Plot, cajoled the Royal Society into purchasing 60 copies of each issue (9). Perhaps, the society sensed a value in the investment that exceeded immediate profitability.

In the long run, the Transactions proved to be a great success and, likewise, the model of scientific dissemination that it pioneered—peer reviewed, edited articles published in print journals and purchased by readers and libraries through subscription. For over three centuries this proved to be a trusted mechanism for scholarly communication. But, we are, of course, in an era of great innovation—and with that innovation comes disruption. Our new communication technologies and the information habits that they encourage are disrupting our old ways of doing and sharing science—as Clayton Christenson framed it, those that attempt to sustain the old ways of doing business in the face of disruptive innovation (whether they be a video rental store, the U.S. Postal Service, society publishers or academic libraries) (10) are likely to face a very disappointing decline.

The good news for RRS and its journal is that in recent decades it has proved to be both resilient and willing to experiment with new dissemination models. Prior to and during the rise of electronic publishing, many society journals found themselves ill-equipped to efficiently publish. As a result, many decided to farm out the work to commercial publishing companies. In the field of Economics, for example, this transformed a journal literature that had been almost entirely published by societies into one that was controlled by commercial publishers—at nearly four times the price (11). A similar picture may be seen in the current Science Citation Index title list, Radiology, Nuclear Medicine and Medical Imaging; 80% (96 of the 120 journals) are published by commercial publishers. At the same time, the commercial journal publishing market consolidated and began to offer bundled subscriptions to libraries. As prices skyrocketed and library budgets were pinched, journal subscriptions outside the bundle, such as those published by small societies, were likely to be cancelled (12). Today, the majority of all journal subscriptions are sold in bundles of

over 50 titles (13). While it is likely that *Radiation Research* has lost much of its unmediated subscription income from academic libraries, RRS has been successful in finding ways to include the title in the aggregations that many libraries do purchase. Thus, for example, after several years with no access for non-RRS members to new issues of *Radiation Research*, non-RRS members at our institutions, IUPUI and the IU School of Medicine, now have access to new issues (published after September 1, 2012, with a six month embargo) through ProQuest Central. *Radiation Research* also sells advertisements, raises some income with \$30 pay per article fees and defrays some expenses with page and color charges and open access fees for the authors that so choose. Thus, *Radiation Research* has survived (and profitably!) the "big squeeze," during which libraries, to save costs during budget declines, canceled subscriptions to journals from small publishers because they were not included in inflexible bundles from large publishers; (12) however, is the journal poised for continued success over the next decade? Is RRS sustaining an old model of revenue generation or is it innovating in ways that prepare it for the future?

THREE FORCES OF CHANGE SOCIETY JOURNALS CANNOT AFFORD TO IGNORE

1. Fee-Based Open Access Publishing

Readers of this journal are likely aware of the author-pays model of peer-reviewed publishing. Perhaps you have received a solicitation from a journal publisher of unknown merit; (14) if not, the growing reputations of PLoS titles [such as: PLoS Medicine, Impact Factor (IF) 15.3; PLoS Biology, IF 12.7] and BioMed Central journals (such as: Genome Biology, IF 10.3; Particle and Fiber Toxicology, IF 9.2; BMC Medicine, IF 6.7; BMC Biology, IF 6.5; Breast Cancer Research, IF 5.9) are hard to miss (15). In short, the typical model works like this: following review and acceptance the author uses grant, institutional or personal funds to pay for publication. Thereafter the article is available at no cost to any reader with Internet access. In our view, this approach to publication is both a symptom of the biggest threat to the future of *Radiation Research* and, most likely, the mechanism that has the best chance of securing a strong future for the journal. Whatever the catalysts might be or have been to prompt the rise of the author-pays open access model, it is the approach that best mirrors the information needs and habits of readers. Faculty expect digital content to be easy to find, access and share. Many of us respond to pay walls not by checking our library's subscription coverage nor by submitting an interlibrary loan request, but by first turning to a "free" resource. As librarians, we are painfully aware of this fact. In 2012, only about 40% of faculty agreed that they were very dependent on the library for their research—at the same time, over 20%

believe that online access to information minimizes the role of librarians (16).

While these attitudes and habits are changing the services libraries provide, they are also driving a market that is moving in favor of author-pays open access. The annual growth rate for new journals keeps pace with the annual growth rate of new researchers—currently around 3.5% (13); in contrast, the growth rate of open access journals exceeds 30% (17). Commercial publishers are responding to market demands by launching new, full and immediate open access journals. They are also providing a “hybrid” model—offering authors a choice, for a fee, to publish an open access article while also collecting revenues from subscribers. Many scholarly societies have made similar investments. As of June 2013, scholarly societies now publish over 700 open access journals.³ Some of these, such as the Journal of Otolaryngology-Head and Neck Surgery, were formerly subscription-only titles. Society published journals, including the Journal of Cardiovascular Magnetic Resonance (IF 4.4) and Biomedical Optics Express (IF 3.2), are also demonstrating that open access encourages readership.

Although making the transition to open access publishing will require careful planning on the part of societies and will involve significant risk, (18) the growth of the open access market cannot be ignored. In fact, some have forecasted that the dominance of the author-pays model is inevitable (19, 20). In this light, most societies cannot afford efforts to sustain a publication model designed for paper-based distribution. In doing so, society journals will lose the competition for quality articles, face a declining readership and, ultimately, lose subscription and advertising revenues.

2. Funder and Institution Mandates

On February 22, 2013, John Holdren, Director of the U.S. President's Office of Science and Technology Policy (OSTP), released a memorandum for all Federal agencies with over \$100 million in extramural research expenditures (21). The memorandum calls for mandated public access, with a one year embargo, to articles resulting from taxpayer supported research. In essence, the OSTP memorandum extends the existing NIH Public Access Policy (22) and the NSF Data Sharing policy (23) to all Federal agencies. The agencies will present their plans for accomplishing the mandate to the OSTP in August of this year. The OSTP mandates add to an international list of funder and institutional policies which is quickly approaching 400—these include agencies that currently fund science published in *Radiation Research* [NASA, DOE, DOD, Wellcome Trust, European Research Council, Research Councils UK (RCUK), Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) and others] as well as

universities whose faculty are likely to submit articles to the journal (Duke, Harvard, UCSF and others) (24). In the year 2011, 220 *Radiation Research* articles were indexed in PubMed MEDLINE; today, 52 of these are available to any reader, no subscription required, in the NIH PMC repository. By our count, if all authors were to comply with existing policies and if the OSTP policies were also counted to apply, another 45 articles from 2011 would now be accessible to readers without a subscription. One might assume that public access to 44% (97/220) of the articles in *Radiation Research* will result in further subscription cancellations. But survey reports commissioned by the publishing industry provide conflicting views (25, 26). In fact, the PEER study found that public access was associated with increased downloads from publisher websites (27). And, furthermore, as we have already noted, libraries subscribe to bundles of titles. In our view, cancellations are more likely a result of other factors, including insufficient budgets and lack of use.

Rather than worry about the loss of subscriptions, small society publishers should prepare to assist authors with compliance. As authors increasingly comply with public access policies, the journals that do not facilitate compliance are likely to see declining submissions of quality work. With regard to the pending OSTP mandates, there are two widely discussed proposals for supporting systems. One would be mediated by a conglomeration of large commercial publishers—The Clearinghouse for the Open Research of the United States (CHORUS) (28); the other would leverage existing repository systems at universities—SHared Access Research Ecosystem (SHARE) (29). It is unclear how, if at all, CHORUS will facilitate the work of small society publishers. On the other hand, SHARE accomplishes public access without isolating smaller publishers. Society publishers with restrictive copyright transfer agreements, however, will need to adjust their terms to (at a minimum) permit authors to self-archive the final accepted manuscript (after a one year embargo) in a university or subject-based repository. Such copyright policies would not only assist authors in compliance, but would also bring society publishers in line with the copyright practices of over 62% of publishers (30).

3. New Evaluation Metrics

While citation counts are still the gold standard for measuring the impact of a scholarly publication, authors and readers are increasingly interested in new tools for filtering and evaluating articles (31). Readers can now find and share an article of interest without browsing a journal issue's table of contents and, thus, a single article may have a readership that differs greatly from other items in the same journal. At the same time, faculty are increasingly adopting social networking tools. Over 44% of faculty use social media in research and education and over 84% of faculty under the age of 35 are frequent social media users (32). These

³ Personal correspondence. Suber and Sutton 2011 Society Publishers with Open Access Journals list, updated June 2013.

changes in how we read, network and share encourage us to look at alternative metrics, or “altmetrics” (33).

Although journal reputation is still important, researchers are becoming less dependent on a particular journal’s impact factor (34). Altmetrics opens the door for a truly comprehensive picture of one’s scholarly output. Readers and authors will grow to expect article level metrics, including the number of times an article is downloaded, the number of tweets, blog posts or online comments about an article, the number of times an article is put into a shared library of articles (such as EndNote or Mendeley), the number of times a table or slide set is shared, and the number of times a data set is used or accessed. In fact, many publishers are already deploying tools for gathering article level metrics. The journals published by Public Library of Science (PLOS), for example, provide usage stats along with citation counts, social network traffic and blog and media referrals (35). These metrics can be used by: researchers to demonstrate the broader impact of their work for promotion and tenure; departments and institutions to more accurately measure the output of their researchers; funders to track trends; publishers to describe a readership and to attract authors; and readers to efficiently filter and discover new and relevant publications.

A PATH FOR RADIATION RESEARCH?

What will the RRS do? In the late 17th century, faced with an inevitable change in scholarly communications, the Royal Society let six years slide by before deciding to invest in the Philosophical Transactions. Today’s society publishers may not have that much time. David Lewis has estimated, on the conservative side, that open access will account for over 40% of journal literature before the decade is out (19). Like the Internet itself, open access publishing is here to stay. We believe increased access to knowledge will speed the pace of discovery. We also anticipate that small society publishers will face some very difficult decisions.

- Will societies fight change and struggle to sustain yesterday’s revenue models? If so, they should start looking for ways to cut costs. A descent into obscurity might seem like a safe route, but it’s certainly a sad one.
- Will societies adopt (or transition to) open access publishing? If so, they may need to form cooperatives and build other economies of scale (36). At the same time, they will have to price their services competitively (37). Recently, *Radiation Research* launched an open access option; the \$2,000 fee plus \$65 per page is comparable to \$2,500 open access choice offered by Elsevier for *International Journal of Radiation Oncology Biology Physics* (IJROBP) and to the \$3,000 open access choice offered by Wiley-Blackwell (publisher of *Journal of Medical Imaging and Radiation Oncology* and other titles) and by Springer (publisher of *European Radiology* and other titles). The *Radiation*

Research open access fee, however, is significantly higher than the fee to publish in the *Journal of Radiation Research* (\$1,200)⁴ as well as to publish in *PLoS One* (\$1,350), higher than most journals published by BioMed Central, such as *Radiation Oncology* (\$1,750), and more than twice the average fee (\$650–\$950) (38) for full open access journals. What cost-recovery level can RRS afford and at the same time fulfill its mission “to promote dissemination of knowledge”?

- Will societies facilitate compliance with public access policies? *Radiation Research* has done an admirable job of shepherding NIH-funded articles to PMC. The journal’s copyright transfer agreement, however, does not accommodate the policies of other international, federal, foundation and academic institutions. Both the NIH and the Wellcome Trust are increasing their compliance efforts (39). Authors may soon begin to look for journals with more agreeable terms.
- Will societies adopt technologies which facilitate new filters and value metrics? Authors already submit to journals that seem to be the best investment of their time and money. Beyond merely the Impact Factor, authors will look for reputable business practices, reliable and efficient review, and both targeted and broad dissemination. Article level metrics will help authors and readers assess the value of a single article independently of the reputation of the journal itself. This reputation will be easier to build on an open access platform.

RRS has a great track record for supporting new science and for publishing good research in its journal. We trust that its members and leadership have the determination, daring, and creativity to address these challenging and difficult decisions. While we watch the evolution of scholarly communications, we look forward to seeing how *Radiation Research* flourishes in publishing markets that favor accessibility. As RRS works to “encourage in the broadest manner the advancement of radiation research”, we are confident that it will likewise “facilitate cooperative research” (1). In our view, there is no better way to do this than to disseminate scholarship in ways that reflect the habits, values and technologies of our era.

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⁴ *Journal of Radiation Research*, published by Oxford Journals on behalf of the Japan Radiation Research Society (JRRS), and the Japanese Society for Therapeutic Radiology and Oncology (JAS-TRO) charges \$560 for society members and \$1200 for non-members.

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