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Medical Science and the Serials Crisis: Is Open Access a Viable Solution?

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Introduction

n 2002 and 2003, several manuscripts were posted to arXiv (pronounced "archive") which laid out the solution to the then nearly century-old mathematical problem known as the Poincaré conjecture. arXiv hosts hundreds of thousands of preprints, or manuscripts not yet published in a peer-reviewed journal, from the fields of physics, computer science, quantitative biology, quantitative finance, statistics, and mathematics. Anyone in the world may access it, free of charge. Thus, in an instant, the solution to one of the most prestigious unsolved problems in mathematics was made freely available to all.

Such easy access to information is not the norm in medicine. In medicine as well as many other fields, access to most of the primary scientific literature is paid for by the audience. A scientist would produce a paper, submit it to a journal for peer-review and publication, and upon publication access would be given only to the audience that has paid the journal's subscription fees. Thus, an information-seeking physician or patient must pass through financial barriers in order to access the latest clinical trials on her disease. Most would agree that unencumbered access to the latest science is extremely important for both physicians and patients, so why has it not become a reality?

The answer requires an understanding of the role of the serials crisis. The serials crisis refers to the rising subscription costs of academic journals and the financial difficulties it poses for subscribers, especially academic libraries. Profit motives on the part of publishing companies, market consolidation due to merging of such companies, and high demand for access among university faculty have led to upwardly spiraling journal prices that are taxing the budgets of the university libraries that subscribe to them., Between 1986 and 2003, the price of scholarly journals increased 215% while the Consumer Price Index, which measures the changes in the price level of consumer goods and services, rose only 68%. For example, the University of North Carolina at Chapel Hill reported that it paid $10,924 for its 2004 subscription to the Journal of the American Medical Association. It has always been in a scientist's interest for her work to see widespread exposure. Thus as publishers began imposing an increasing financial barrier to access their work, some scientists began to look for an alternative way to distribute their papers.

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An Array of Open Access Models Emerge

In response to the serials crisis, several models of open access science publishing emerged and the Internet proved to be a natural medium on which these models could grow. The aforementioned arXiv was an early example in which preprints, early drafts of papers to be submitted to traditional peer-reviewed journals, were hosted on the Internet to be freely accessed by all. Since its establishment at Cornell University in 1991, around 600,000 preprints in physics, mathematics, and computer science have now become available for download. In 1994, Steven Harnad issued his "subversive proposal" that scientists self-archive their papers on the Internet, reasoning that this would allow wider dissemination

of their work than publication in increasingly costly subscriber access-only journals. In medicine the efforts of Harold Varmus, co-recipient of the 1989 Nobel Prize in Physiology or Medicine, former director of the National Institutes of Health, and current director of the National Cancer Institute, to create a medicine-specific version of arXiv resulted in the birth of PubMed Central, a free repository of electronic peer-reviewed scientific literature.

Open access efforts to date fall roughly into one of two camps, known as "green" and "gold" open access. Green open access, currently the more popular of the two, refers to the practice of publishing an article in a non-open access journal that grants the author permission to self-archive, or upload the article to some sort of open access archive, be it an institutional-specific or third party-administered archive. Gold open access, on the other hand, refers to the direct publishing of an article in an open access journal. BioMed Central is an example of a gold open access publisher of electronic journals, funded not by the traditional subscription fees but by payments from the authors of submitted articles. In recent years, open access publishing has gained momentum and is now a significant contributor to scientific literature. A recent study estimated that 21.7% of academic medical journal articles were published in either green or gold open access form.

While many publishers have been willing to grant authors the permission to self-archive, not all are fans of open access. Publishing companies, working with trade groups such as the Partnership for Research Integrity in Science and Medicine (PRISM), have voiced objections to this movement. Among the main criticisms is the claim that open access publishing results in inadequate peer review, diminishing the quality of the published science. Without charging for subscription, traditional journals argue that it will be difficult to pay the costs required to support a robust peer review infrastructure. Open access efforts have attempted to work around this problem either by publishing preprints or using non-traditional methods of peer review. Articles submitted to the Harold Varmus-founded open access journal PLoS ONE undergo an abbreviated initial peer review process and are then reviewed by readers after publication – a system known as "open peer review." A few years ago, the prestigious journal Nature experimented with open peer review but encountered weak reader participation in the review of posted articles. Nature eventually chose not to adopt open peer review. However, it did not end its foray into open access entirely. On January 6, 2011, Nature issued a press release announcing the creation of a gold open access journal, Scientific Reports, which will not rely on an open peer review process. Instead, it will use a modified version of the traditional peer review system in which there are no in-house editors. An Editorial Board Member either conducts the review herself or sends the paper to one or more referees for peer review. In order to establish which papers are most important, the most frequently downloaded, blogged, or emailed papers will be listed on the Scientific Reports website – a feature reminiscent of the reader-driven participation crucial to open peer review.

Proponents of preprint servers such as arXiv note that "amateur postings" are "surprisingly rare." Open access advocates argue that open access and peer review can coexist and even suggest that open access journals may be better able to adopt improved peer review methods than traditional journals. Responding to fears of financial viability, open access proponents point out that a multitude of open access journals, including those published by BioMed Central, are supported by fees paid by authors, not subscribers. In addition, they argue that open access articles are cited more often than non-open access articles, although there is disagreement as to whether this is due to a statistical bias wherein higher quality papers tend to be available on an open access basis compared to lower quality papers.

Conclusion

The combination of the serials crisis and the emergence of the Internet convinced many scientists of the necessity and viability of open access science publishing. Despite the strides made in recent decades, progress towards universal open access has been and continues to be characterized by mixed success. A

variety of open access schemes are in play and evolving due to financial and logistical pressures as well as pushback from traditional publishers and groups like PRISM. The opportunity to create new publications has also given publishers a chance to overhaul the peer review process. Time will tell which scheme, if any, will prevail.

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