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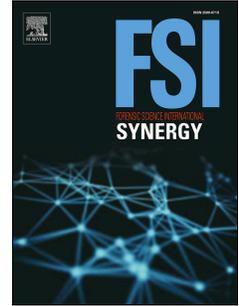
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What is open-access publishing and what it means for the forensic enterprise

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“An old tradition and a new technology have converged to make possible an unprecedented public good.” The first sentence of the Budapest Open Access Initiative declaration.

INTRODUCTION

Science is a public endeavor the results of which are intended to be shared with other scientists, professionals, and the public (Feibleman, 1972). This is viewed as a worldwide right: Article 27 of the *United Nations Declaration of Human Rights* states that "Everyone has the right to freely participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits." (United Nations, 1948). The publishing of scientific advancements began in 1665 with *Journal des savants* and the *Philosophical Transactions of the Royal Society*. Since then, it is estimated that about 50 million journal articles have been published (Jinha, 2010). At the outset, the idea of publishing scientific results was mocked and created controversy, through difficulties in publishing (like the plague and the Great Fire of London) and scandal (the first editor, Henry Oldenburg, was accused of passing information to an enemy nation while corresponding with a Dutch colleague) (Garner, 2015). The Royal

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Society was adamant, however, that science advanced only if a free and open discourse and exploration of ideas, supported by empirical evidence, was allowed.

Early scientific journals were typically either run by a single editor who had control over the final published materials exerted editorial control over the content or by a group who jointly determined the final content to be published, a nascent approach close to what is now recognized as peer-review. Peer-review did not become standard until the mid-20th century and the abstract was not routinely used until about 1920 (Gross, et al., 2002). Despite its more-than 350 year history, many of the aspects of scientific publishing are modern.

Scholarly disciplines now rely on the publishing industry. Publishing is a key factor in advancing an academic or scientific career; the results need to be communicated clearly, readily discovered, and warehoused (or archived) so that others may find the same information. As most scientists know, to get published a manuscript is submitted to a journal and that journal's editor(s) assign it to one or more relevant scientists (not involved in the research or writing) who review the paper and decide if the paper has scientific merit, is credible, and is appropriate for the journal's topics of publishing. Traditionally, papers are submitted free of charge to the author; the publisher pays the costs of operating the journal by charging for subscriptions, which are paid for by association dues (individual subscriptions) or university libraries (individual or bundled subscriptions).

WHAT IS OPEN ACCESS PUBLISHING?

The "reader pays" model has been the dominant mode of obtaining scientific information for centuries. As with nearly every other industry, the advent and growth of the Internet have disrupted the science publishing market. Content began appearing online, search engines found journals that scientists did not have access to through their library subscriptions, and the library stacks were quickly being augmented or

replaced by the computer. Clicking on a journal article to download was easy, so long as the researcher's library had a subscription to that journal; if not, although the abstract could be read for free, the full article was behind a paywall.

A growing movement emphasized a dilemma in this model: Most scientific research was publicly-funded through grants from funding agencies that had taken tax or government dollars and the outcomes and data should be considered as public goods. Having to pay, most times out of pocket, for paywalled articles generated from public monies rankled many scholars. In December 2001, a group of 13 researchers drafted what is called the Budapest Open Access Initiative (BOAI)⁵, which outlines a set of principles for open access publishing. To date, the Initiative has been signed by some 6141 individuals and 976 organizations.

As the desire and demand for open access publishing grew, it gained support from a number of countries and foundations. A tipping point came with Plan S, created by science agencies from 11 European countries (Science Europe). Plan S requires scientists who received grants from funding agencies in these countries to publish their work in open-access journals or freely-accessible websites by 2020; this deadline has recently been amended to January 1, 2021 (Else, 2019). The plan also restricts the researchers from publishing in about 85% of journals and periodicals, including high-profile ones, like *Nature* and *Science*. Thus, from 2021 scientists who receive funds from any of those agencies will have to follow the open-access parameters. Other countries, agencies, consortia, and funding agencies have also adopted and, in some cases, demanded open access publication (more on this later).

⁵ <https://www.budapestopenaccessinitiative.org/>

HOW OPEN ACCESS JOURNALS WORK

Without paying either through subscription or via paywall, how do open access publications cover their costs? In the open access model, the fee structure is flipped and authors pay to have the costs of publication covered. The author publication charge (APC) for an manuscript submission varies depending on the journal, up to several thousand dollars (Figure APC). The APC is determined by the information technology requirements, production work, amount of copy-editing, peer review, and rejection rates. A journal that conducts little peer review and light copy-editing probably will charge a lower APC. A journal that has a distinctive presence in a field and a specific audience, that does full copy-editing and full peer review will charge a higher APC, all things considered. The APC may vary by the length of the paper, as well, with reports garnering a lower fee than full research papers (Figure 1).

<insert Figure 1 near here>

Figure 1. Article Processing Charges for over 1500 Gold Open Access journals (data from 2019). *Source:* Thomas Shafee, doaj.org/faq#alldata.

Much of the work that was done in the print days of publication remains the same or similar in the digital age. The Editor(s) oversee the content of the journal, finding and inviting reviewers, making sure the reviews are timely and relevant, and generally guiding the journal and its activities. Production editors still manage the copy-editing and layout of the articles in the journal's particular style. Finally, the publisher works with the Editor(s) and the editorial board the strategic development and logistics of the journal and its progress. Publishers maintain the complicated organization of IT systems that accept, arrange, store, and provide communications that make sure published articles are archived, accessible, follow standards for referencing and content searches. The IT systems can include other benefits or checks, such as plagiarism detection software and reviewer searches in other publications.

LEVELS OF OA

Several levels of open access publishing are recognized:

- **Green:** The author and the journal both publish the content to websites, one controlled by the author and one by the funding agency that funded or hosted the work. The content is free to read, download, and re-use.
- **Bronze:** Content is published initially as subscription only, then release them to open access after an embargo period (typically months).
- **Hybrid:** Some articles are free (and perhaps for a time) but most are accessed via a subscription to that journal.
- **Gold:** All articles are free to read, download, and re-use in perpetuity.

WHAT ARE THE BENEFITS TO PUBLISHING OPEN ACCESS?

The first and main benefit is to the reader: Open access articles are free for anyone to download and use. This makes the information readily available with minimal resources to anyone interested in the work. Authors also benefit from the open availability of their work and several studies indicate an association between open access publishing and increased citations, leading to greater impact for open access articles. In one study, non-open access content was twice as likely to remain uncited six months post-publication than open access articles. Open access articles also saw more than double the average number of citations than non-open access articles. Articles in Gold Open Access journals had a higher overall academic impact (Eysenback, 2006) (Figure 2). Another benefit to authors is that most open access journals do not request or receive copyright from authors. Publishers are granted non-exclusive rights to publish. Therefore, the authors own their work.

<insert Figure 2 near here>

Figure 2. Percentage increase in research articles in PubMed Central from 2000 (Waldner and Collister, 2016).

The open access model may seem to have a disadvantage, namely researchers in developing countries who may not have funding sources for APCs. To address this lack of resources, Research4Life (research4life.org) and the Directory of Open Access Journals (DOAJ) announced a public-private

partnership between United Nation agencies, universities, and publishers, to reduce the knowledge gap between developing and industrialized countries by providing free and low-cost access to scientific research publications. While Research4Life does not directly cover OA publication costs, many publishers provide full or partial waivers if they are based in countries eligible by Research4Life. The reduction or elimination of the APC for Research4Life countries should spur publication and open their scientific communities to a wider world.

PREDATORY JOURNALS

Anyone in academia with an email inbox has received invitations to publish research in a journal that seems legitimate but also somehow seems or objectively is questionable. These so-called “predatory journals” encourage publishing open access through them, sometimes for exceptionally low APCs, but do not check articles for quality, copy-edit, or provide other editorial and publishing services that legitimate journals provide (open access or not). Prater (n.d.) offers some ways to tell if a journal may be predatory:

1. The journal asks for a submission fee instead of a publication fee or tries to keep the copyright to authors' work.
2. The editorial board is very small or “coming soon.”
3. A single publisher releases an overwhelmingly large suite of new journals all at one time.
4. The journal says an issue will be available at a certain time, but the issue never appears.
5. The website is not professional in quality.
6. The journal title notes a national or international affiliation that does not match its editorial board or location.
7. There are fundamental errors in the titles and abstracts.
8. The content of the journal varies from the title and stated scope.

Some predatory journals publish already-published papers to fill their rosters. Many will not relinquish or remove an article once the author discovers the true nature of the journal and wishes to publish elsewhere; some will require a fee to remove the article and then not remove it (Molteni, 2016).

IS OPEN ACCESS THE FUTURE OF PUBLISHING?

MANDATED SUPPORT

In 2008, the U.S. National Institutes of Health (NIH) mandated that researchers submit final peer-reviewed journal manuscripts to the digital archive PubMed Central no later than 12 months after they had been accepted for publication. Following the European Commission's announcement about open access publishing, the U.S. Office of Science and Technology Policy (OSTP) advised all U.S. funding agencies that spend more than \$100 million on external research and development to make publications on supported research freely available online after a suggested 12-month embargo. The Registry of Open Access Repository Mandates and Policies (ROARMAP⁶) provides a searchable international database of agencies with open access requirements. As of February 2019, mandates have been registered by over 700 universities (including Harvard, MIT, Stanford, University College London, and University of Edinburgh) and over 100 research funders worldwide.

FINANCIAL SUPPORT

The BOAI briefly discussed sources of funding to cover the costs of open access publications, stating,

There are many alternative sources of funds for this purpose, including the foundations and governments that fund research, the universities and laboratories that employ researchers, endowments set up by discipline or institution, friends of the cause of open access, profits from the sale of add-ons to the basic texts, funds freed up by the demise or cancellation of journals charging traditional subscription or access fees, or even contributions from the researchers themselves. There is no need to favor one of these solutions over the others for all disciplines or nations, and no need to stop looking for other, creative alternatives.

In the forensic science enterprise, universities and research institutes could follow the now-normative process of funding APCs through institutional funds or research grants. But what about operational forensic laboratories? Research, validation studies, and other scientific advances deserve--and demand--a broader audience, including researchers, attorneys, judges, and other professionals. Most forensic

⁶ <http://roarmap.eprints.org/>

laboratories are strapped for funding as it is and so APCs initially seem like one more burden on an already-beleaguered agency. But if the publication of this research and these studies are tied to accreditation activities (legislatively mandated in some states) then the question of funding becomes easier to answer. By publishing research on methods and other reports or studies, forensic laboratories relieve the burden of providing materials in discovery, provide leadership in the science, and promote transparency about what they do and how they do it.

THE FUTURE

As Stern and O'Shea (2019) note,

“Open-access publishing platforms are positioned to increasingly complement—and perhaps eventually replace—journals as major publication venues for primary research articles...Over time, however, we believe that the scientific community will come to support a progressive open publishing model that accelerates discovery and empowers scientists.”

This idea is born out in the growth of Gold Open Access journals (Figure 3) and this relates to the acceptance of Open Access as a publishing model. A recent survey by Springer Nature found that over 70% of respondents agreed that all future research articles and research data should be accessible via open access; further, 91% of responding librarians agreed that ‘open access is the future of academic and scientific publishing.’ (Anon, 2018).

<insert Figure 3 near here>

Figure 3. Growth in Gold Open Access journals. *Source:* By Thomas Shafee - Own work, CC BY 4.0, <https://commons.wikimedia.org/w/index.php?curid=77222864>.

Currently, two journals in the forensic science realm publish as Open Access, *Forensic Science International: Synergy* and *Forensic Science International: Reports*. *Forensic Science International: Synergy* welcomes significant, insightful, and innovative original research with the aim of advancing and supporting forensic science while exceeding its expectations for excellence. By being freely available to anyone, we seek to promote and support open discourse across diverse areas of interest, avocation, and

geography. Papers are invited from all forensic sciences and influencing disciplines, including but not limited to the humanities, life sciences, social sciences, and the law. Cross-disciplinary collaboration promotes innovative approaches, encourages systems-level perspectives, and seeds the literature with insightful opportunities. Because the good management of science can be as important as the science itself, the journal welcomes articles on issues related to forensic science policy and management.

Management, human resources, economic studies, policy implications of new methods or technology, and any other work intended to improve the effectiveness, efficiency, quality, and operations of forensic science laboratories as well as to the education and training of forensic scientists. In addition, the journal welcomes manuscripts on the governmental and institutional policies that affect the practice and management of forensic science. *Forensic Science International: Reports* seeks to foster information and knowledge exchange through the publication of short communications and data articles across all subject areas within the forensic sciences. Published content that consolidates and validates existing knowledge through documented testing and peer review serves as a valuable benchmark standard for good practice. The continued advancement of forensic science hinges upon rigorous testing of methods, ethical integrity in reporting, and equity across the boundaries of discipline or geography. Our aim is to rapidly disseminate quality reports while adhering to these principles, which we strongly believe are paramount to forensic science and its role in criminal justice. *FSI: Reports* is a sound science journal, meaning that any submission reporting original and methodologically sound results, which adheres to accepted ethical and scientific standards, will be published regardless of its perceived impact. Both journals are fully peer-reviewed.

Open Access publications in forensic science mean a new chapter in transparency of science, methods, policies, validation studies, case reviews, and population data. By being freely available to anyone anywhere, forensic Open Access journal content is not limited to those who have libraries or who can pay: The content is available to scientists, attorneys, law enforcement, investigators, judges, paralegals, really anyone involved in the criminal justice system, including the public forensic scientists serve.

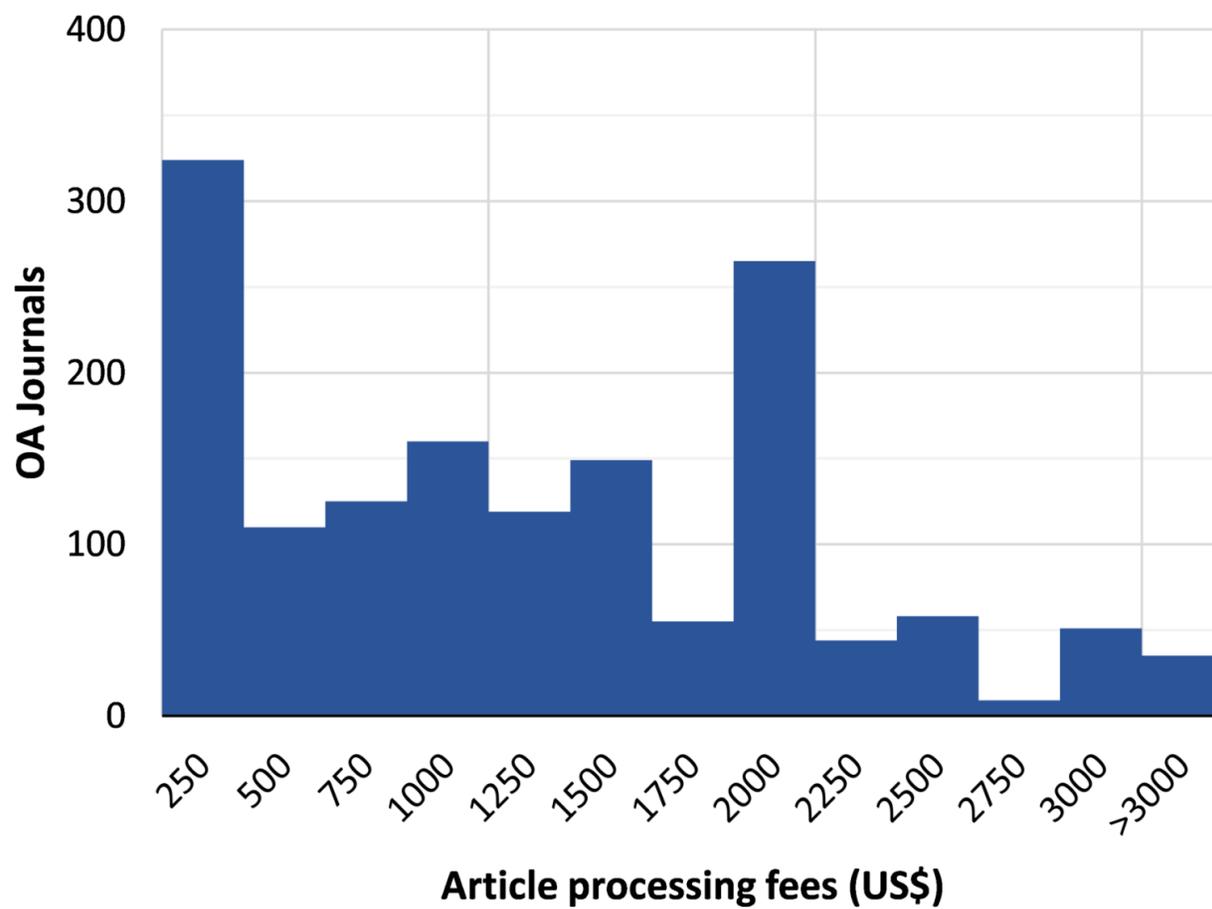
Providing freely available peer-reviewed scientific and policy research means greater access to knowledge and methods that can improve justice and how forensic science supports it around the world.

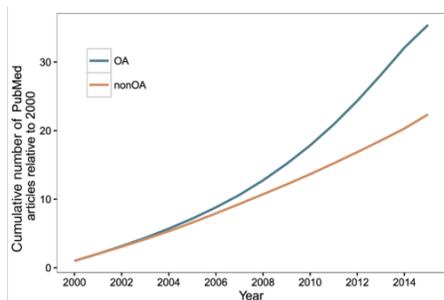
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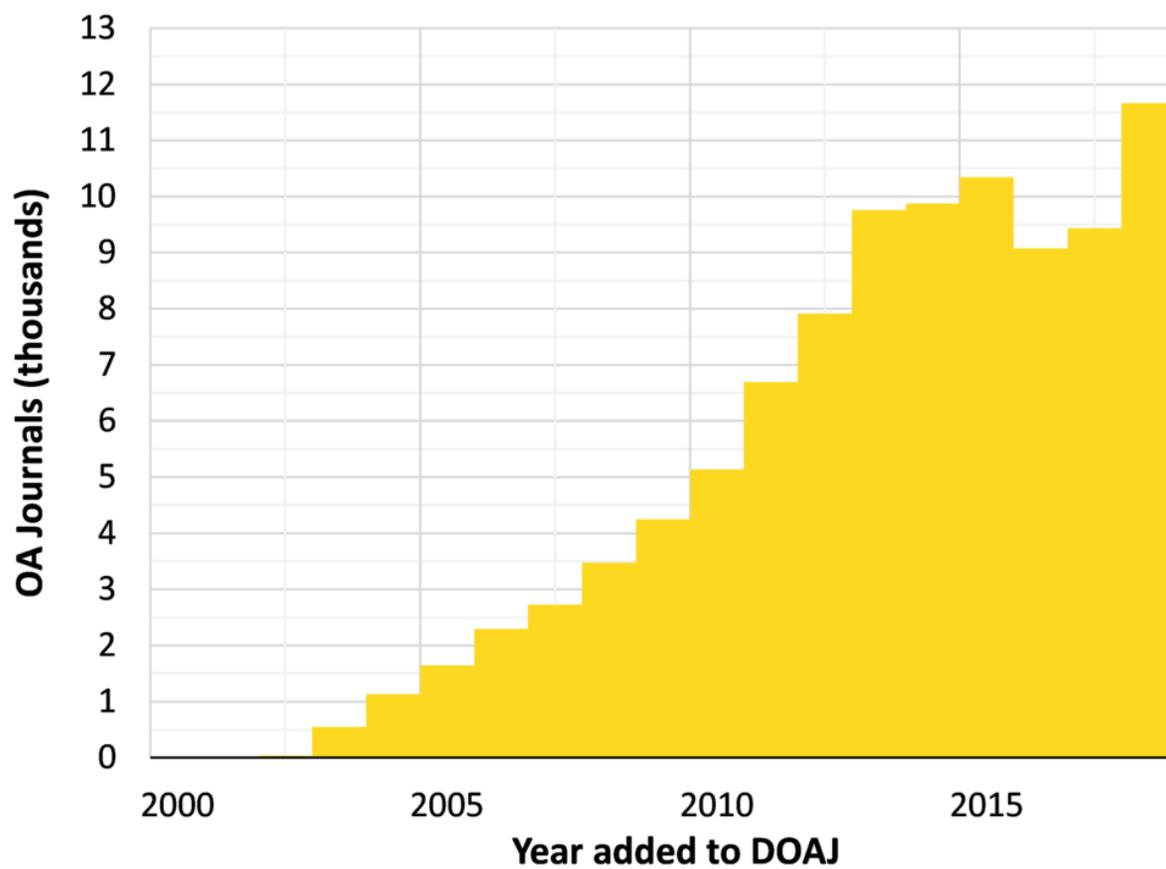
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