

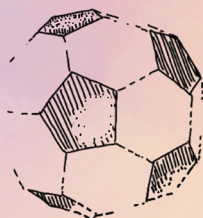
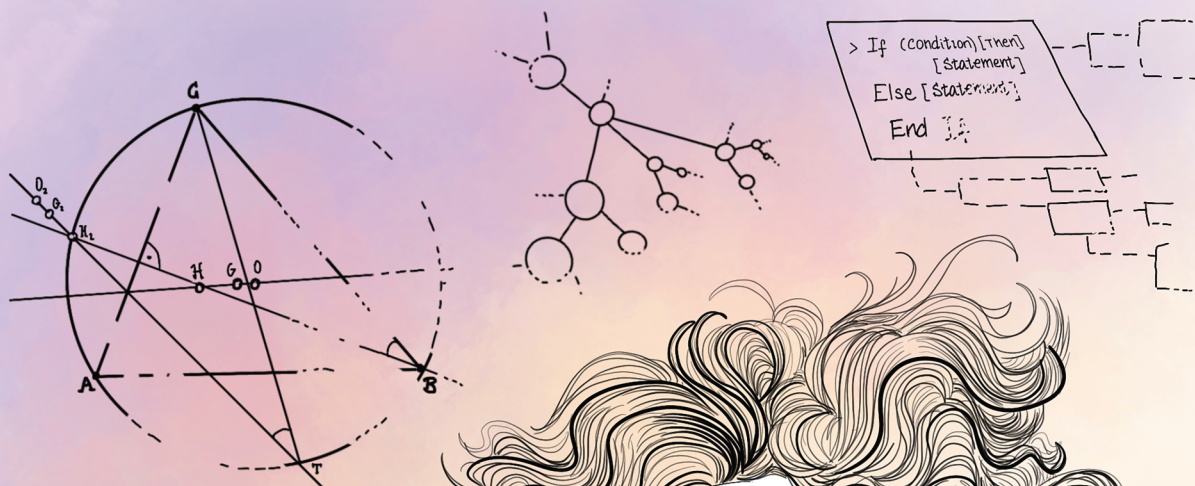


Notices

of the American Mathematical Society

March 2023

Volume 70, Number 3



Yulia
Zdanovska
(2000-2022)



AMS Primer on Open Access

Robert M. Harington

Introduction

Open Access (OA) refers to published scholarly content (such as journal research articles, and books) made openly available in online digital form. This content is free of charge at point of use, free of most copyright and licensing restrictions, and free of technical or other barriers to access (such as digital rights management or requirements to register to access). Typically, OA is associated with reuse licenses, primarily, Creative Commons¹ licenses that allow for reuse of the content.

Public Access (PA) refers to access mandated by the White House Office of Science and Technology Policy (OSTP). PA differs from OA in that content is made freely available under terms defined by OSTP and federal funding agencies. Articles and data are made freely available to all, but are not associated with reuse licenses.

Communicating and sharing discoveries is an essential part of the research process. Any author of a research paper wants it to be read. Therefore, the fewer restrictions placed on access to those papers means that more people may benefit from the research. In many ways, the OA movement is very much in line with the shared mission of researchers, scholarly societies, and publishers.

Journal publishing programs perform many services for researchers including peer review, communication, and career advancement. In society publishing programs, revenue from journal publishing directly supports the important work societies do on behalf of their scholarly communities.

How do we maximize the dissemination of knowledge while at the same time maintain both a high level of quality and a sustainable financial future for our professional society, the AMS?

The OA movement can be traced to a letter from the year 2000, signed by some 34,000 researchers, demanding publishers make all content free after 6 months. The signatories of the letter said they would boycott any journals

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¹<https://creativecommons.org/licenses/>

refusing to comply. In 2002, the accepted definition of OA was encapsulated in the Budapest Open Access Initiative² declaration.

While the threatened boycott never materialized, an antagonistic tone was set, and this has marked much of the discussion around OA to the present day. There has been a lot of unproductive argument and invective, rather than efforts to find common ground. Unfortunately, advocacy for balanced discourse has floundered, resulting in societies, such as the AMS, contemplating how to tread independently with a posture of balance and reason.

In 2013, the OSTP issued policy guidance to federal agencies in the form of the OSTP memorandum on “Increasing Access to the Results of Federally Funded Scientific Research” (the “2013 Memorandum,” also widely referred to as the “Holdren Memo”³ because it was issued by John Holdren, at the time the Director of OSTP). The Holdren Memo directed federal agencies in the U.S. with annual research and development budgets of more than \$100 million to develop policies to ensure public access to federally funded research. The Holdren Memo mandated a 12-month post-publication embargo period for papers stemming from federally funded research. By “post-publication embargo period,” the Holdren Memo was referring to the period between publication of an article resulting from funded research in a journal and the freely accessible public release of that journal article in the form of either the author accepted manuscript (AAM) or the final published version of record (VOR).

On 25th August, 2022, Alondra Nelson (Interim Director of OSTP) issued a memorandum titled “Ensuring Free, Immediate, and Equitable Access to Federally Funded Research.”⁴ The memo is known as the “Nelson Memorandum.” It is accompanied by an impact statement titled

²<https://www.budapestopenaccessinitiative.org/read/>

³https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf

⁴<https://www.whitehouse.gov/ostp/news-updates/2022/08/25/ostp-issues-guidance-to-make-federally-funded-research-freely-available-without-delay/>

“Economic Landscape of Federal Public Access Policy”⁵ (the “2022 Impact Statement”), which was submitted to Congress pursuant to the Consolidated Appropriations Act, 2022. The memorandum directs federal agencies to develop policies that will require free public release of research articles upon publication, and that all supporting research data behind the articles be similarly made immediately and freely available.

In this update to the original AMS Primer on Open Access released in 2019, we discuss potential implications of the “Nelson Memorandum” public access memo for the mathematics community. We also consider developments in Europe from cOAlition S⁶ funders, and other European funding agencies, as they also have a potential impact on the AMS publishing program and the global mathematics community.

Open Access (OA) Categories

The AMS recognizes openness as important, but also wants to balance this ideal with pragmatic business models that allow the AMS to continue providing services to the mathematical community.

Approaches to OA may be considered in terms of *what* is made open, *when* it is made open, and *where* it is made open. Taking a peer-reviewed journal article as an example, three stages may be distinguished:

Stage 1—Author’s original: this is the author’s unrefereed draft manuscript intended for consideration by a journal, also called a preprint. Authors usually retain copyright over this version of the manuscript.

Stage 2—Author accepted manuscript: this is the author’s final refereed manuscript accepted for publication by a journal, containing all changes required as a result of peer review. From this stage, copyright is typically assigned to the publisher, or an exclusive license is granted.

Stage 3—Version of record: this is the final published, citable article available from the journal’s website. Copyright is now retained by the publisher as an exclusive license.

Bearing in mind these OA stages, there are a number of OA models in use today:

1. **Gold OA** is usually meant to describe when journal articles (*version of record*) are freely available to the reader immediately upon publication because the author has paid an article processing charge (APC). It is worth noting that this changes the business model for a journal from being reader-centric (reader or library pays to access the article) to author-centric (author pays for OA). Most publishers who offer Gold OA do so either as pure Gold, in other words, all articles are supported by APCs; or as hybrid Gold, in other words,

a journal contains some OA articles supported by APCs and other articles that are behind a paywall. Either of these scenarios allows for deploying a transformational “read & publish/publish & read” model, which will be described in more detail later in this document.

2. **Green OA** is when articles (most often the final *author accepted manuscripts*) are made freely available at no cost to the author or reader. This can happen when the author deposits the article in an external repository (e.g., personal web page, their institution’s noncommercial repository, arXiv.org) or the article (*version of record*) becomes open in the online version of the journal after a time delay known as an embargo period.
3. **Diamond/Platinum OA** is when articles (*versions of record*) are freely available immediately upon publication with no cost to the author or the reader. The majority of fully open access journals listed in the Directory of Open Access Journals⁷ follow this model. These journals tend to be small ones funded by private grants or by a host institution or library.

Journals that publish articles exclusively under the pure gold or platinum methods are called “fully OA.” Journals that employ a combination of the traditional subscription model along with some OA options are “hybrid” journals. A hybrid journal has some content that requires a subscription (“behind the paywall”) and some that is freely available (“open access”). A “mirror” journal shares the same editorial board as a traditional subscription model journal but is itself a separate, Gold OA publication. The difference between “hybrid” and “mirror” journals matters, as there is currently some controversy from certain funding agencies pertaining to this distinction. This will be explained more below in the discussion of new funder-driven OA initiatives.

OSTP Public Access (PA) Mandate August 2022 (the “Nelson Memorandum”)

Key points to note are:

1. The OSTP is mandating zero embargo public access, not open access—in other words, free to read to all, but not necessarily associated with Creative Commons reuse licenses.
2. For now, this is an unfunded mandate—in other words, no extra funds have been provided to federal agencies to incorporate publications costs.
3. The zero embargo policy applies to all authors on a publication, not just corresponding authors.
4. The memo does not clearly specify what version of research papers this policy will apply to.
5. Immediate public access to underlying data is required.
6. Metadata is a focus—in other words, the policy requires collecting and making publicly available metadata

⁵<https://www.whitehouse.gov/ostp/reports/>

⁶<https://www.coalition-s.org/>

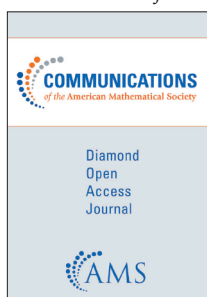
⁷<https://doaj.org/>

associated with publication such as author names, affiliations, dates of publication, sources of funding etc. This is done via the use of persistent identifiers.

- The policy goes into effect by the beginning of 2026. It is not yet clear if this means the policy will take effect with grants issued after January 1, 2026, which seems likely.

Current State of AMS Open Access (OA) and Public Access (PA)

The AMS currently publishes its new flagship journal, *Communications of the AMS* (CAMS) in a Diamond OA model.



AMS currently has two Gold OA journals with APCs discounted to \$750 (currently waived for AMS members)—*Proceedings of the American Mathematical Society, Series B* and *Transactions of the American Mathematical Society, Series B*. These journals were launched in 2014 as spin-offs (“mirror” journals) from their parent journals, sharing the same editorial board.

Articles published in AMS Diamond and Gold OA journals are distributed under the terms of one of the following licenses:

- The Creative Commons Attribution-Noncommercial License⁸ (CC BY-NC), which excludes commercial use. This license lets others remix, tweak, and build upon the article noncommercially; the new work must credit the original article and be noncommercial.
- The Creative Commons Attribution License⁹ (CC BY). This license lets others distribute, remix, tweak, and build upon the article, even commercially, as long as credit for the original article is given.

Authors retain copyright to their articles under both CC BY-NC and CC BY.

The AMS is fully compliant with green OA. In all of our journals, AMS authors may post an accepted, pre-publication version of a journal article on their personal web page, on their institution’s noncommercial repository, and on arXiv.org. In this model, there are no processing fees, and the article is included in a subscription journal. All AMS subscription research journals¹⁰ are green OA journals.

The embargo period for AMS journals is five years. This means all AMS version of record articles are publicly available (“open”) five years after publication.

Some funding agencies require their authors to publish green OA articles within one year of publication. In these

cases, the AMS works with the non-profit organization CHORUS¹¹ to facilitate free access to the accepted manuscript version of the article (not the version of record) following the allowable embargo period of one year. Through CHORUS we can track these articles and this may be seen on the CHORUS Dashboard.¹²

AMS staff looked at AMS journal articles published from 2018–2022 (ytd) in our research journals: *Journal of the American Mathematical Society* (JAMS), *Proceedings of the American Mathematical Society* (PROC), *Proceedings of the American Mathematical Society, Series B* (BPROC), *Transactions of the American Mathematical Society* (TRAN), *Transactions of the American Mathematical Society, Series B* (BTRAN), *Mathematics of Computation* (MCOM), *Memoirs of the American Mathematical Society* (MEMO), *Conformal Geometry and Dynamics* (ECGD), *Representation Theory* (ERT). *Communications of the American Mathematical Society* (CAMS) was excluded as it has only just been launched.

BPROC and BTRAN are Gold OA “mirror” journals with the same editorial boards as their parent journals.

- Total articles: 4,512
- Grant supported: 2,180—42%
- U.S. federal supported: 838—18.5%
- cOAlition S supported: 572—13%

Assumptions: In cases where multiple funders are listed, it is possible that they are listed in order of level of support, but this is just an assumption. Included in the count is any article listing U.S. federal (or cOAlition S) funding, regardless of position in the authors’ listing order.

Any AMS response to the OSTP memo’s requirements will need to be considered in context of the U.S. federal funding agencies response to the OSTP mandate. Most federal funds for mathematics research are provided through the NSF. The NSF supports more basic research in mathematics—done at colleges and universities—than any other federal agency. NSF’s annual budget represents approximately 24% of the total federal budget for basic research conducted at U.S. colleges and universities; in mathematics, the percentage is much higher at 71%.

Although NSF grant guidelines permit grant writers to request funds for APCs, this has not been widely used by mathematicians. There is a concern that if the OSTP memo’s requirements remain an unfunded mandate, precious grant dollars reallocated to APCs will lead to other research elements of the grant proposals becoming unfunded.

We are communicating with funding agencies, focusing on NSF, using the following talking points:

- As funding agencies develop their policies, societies should be kept in mind. Cultural differences in academic communities such as mathematics should be considered.

⁸<https://creativecommons.org/licenses/by-nc/3.0/>

⁹<https://creativecommons.org/licenses/by/2.0/>

¹⁰<https://www.ams.org/journals/>

¹¹<https://www.chorusaccess.org/>

¹²<https://dashboard.chorusaccess.org/publishers/ams#/summary>

2. How might the AMS comply with zero embargo PA, without relying on Gold OA?
3. The AMS has equity concerns about choices of where to publish for those who may have access to APC funds and those who do not.
4. At present this is an unfunded mandate. Are there likely to be funds appropriated to this policy?
5. Reuse licenses (Creative Commons licenses) are potentially an issue—will the author's peer reviewed accepted manuscript, without reuse licenses attached, be acceptable?
6. We worry about society sustainability, given that 70% of our revenue is derived from publishing product sales, including 22% from journal sales.

Benefits and Risks of Open Access

The AMS publishes a broad portfolio of high-quality journals. When considering the benefits and risks of adopting OA models for journals, it is important to note there are significant costs associated with publishing journals. These costs include, for example, expenses related to editorial office management, peer review management, technical manipulation of LaTeX files, workflows for tools such as AMS Math Viewer, systems for processing, presentation and sale of print and online products, marketing and strategic journal development, public awareness, and in-house expertise on best-publishing practices.¹³

Benefits of OA

There have been few rigorous studies on the benefits of OA. One such study is (Davis P. M. (2011) vol. 25 no. 7 2129–2134).¹⁴ This research shows that OA articles received significantly more downloads than subscription articles and reached a broader audience—basically twice as many full-text html views, a 62% increase in PDF downloads and more than 30% more unique visitors. Citations, however, remained flat—despite wider readership there was no similar increase in citation of OA articles.

The results indicate that OA is a valuable tool for broadening access to the research literature. OA publishing extends information beyond the research community.

A recent report from (Digital Science—January 2019)¹⁵ indicates countries that have invested in OA publishing over the last decade have typically increased their level of international collaboration.

Risks of OA

Gold OA

Gold OA appears to be effective for increasing access to journal articles, yet it also introduces some unintended

consequences. The business model for Gold OA shifts financial responsibility from the readers (who currently pay, or have their institutional libraries pay, to access articles) to the authors (who now must pay, or have their institutions or funders pay, to make their articles available to be read).

OA costs land on the author, rather than being distributed across a large number of readers. This creates a system where you have to pay to publish. In our discipline of mathematics, the percentage of federally funded researchers is relatively low at around 25%. Other scientific fields rely more heavily on federal funds, as seen in this chart from the National Science Foundation.¹⁶

Much of the drive toward Gold OA comes from the biomedical world, where research funding is more prevalent. Although many societies and publishers are launching new Gold OA journals, with relatively fewer mathematics researchers having access to funding, one size cannot fit all.

For established journals, the equation is different. A society such as the AMS relies on subscription revenues to generate income, which enables it to provide services to its members and the global mathematical community. *For the AMS, publication revenues account for approximately 70% of its operating income, including 22% from journal sales.* It is naïve to anticipate that APCs could adequately replace subscription revenues. Indeed, the modest APC we now have for our Gold B-series journals does not fully cover the costs associated with publishing an article, let alone generate revenue that could be made available to the general AMS operating budget.

While many researchers consider current APC rates too high, the reality is that they would likely need to be a lot higher for most journals to remain sustainable. For a Gold OA journal, the only revenue comes from the articles you accept. The more stringent the quality control, the greater the effort (and expense) of reviewing and rejecting articles.

A significant problem with the Gold OA path is that Gold OA introduces a lack of equity and inclusiveness into the research ecosystem. A recent editorial in *Science* describes this well (*Science*, Vol. 377, No. 6613, “Public Access is not Equal Access,” Sudip Parikh, Shirley M. Malcom, Bill Moran).

“Public access should foster a diverse universe of authors and readers regardless of their economic circumstances. This drives scientific excellence and public understanding. Some models for public access are bad for inclusivity. Gold OA journals, for which authors pay publication charges, work for senior scientists who are well-funded, tenured, and overwhelmingly male and white, but not so much for early-career scientists who may be poorly funded, not yet tenured, and much more diverse. Also disadvantaged are scientists at smaller schools, including historically Black colleges and universities, and in underfunded disciplines like math and the social sciences. Although it enables ‘open

¹³ <https://publicationethics.org/>

¹⁴ <https://faseb.onlinelibrary.wiley.com/doi/abs/10.1096/fj.11-183988>

¹⁵ <https://www.digital-science.com/blog/2019/01/the-ascent-of-open-access-report/>

¹⁶ <https://www.nsf.gov/statistics/2016/nsb20161/uploads/1/8/at05-20.pdf>

access' to readers, this model can be inequitable for many scientists and institutions."

The Science editorial goes on to say: "As a scientific membership society, AAAS seeks the best path forward for the enterprise it serves. We are actively seeking to balance the tensions between equitable access for readers and equitable access to publishing. As such, Science is made available through progressively priced licenses whereby larger, more research-intensive institutions pay more. We will soon provide immediate public access to all taxpayer-funded research through a policy called 'Green OA-zero day,' which allows Science authors to post their 'author accepted manuscript' (a fully peer-reviewed and revised version), without delay or incurring additional fees, in a public repository of their choice. This approach allows immediate public access without requiring authors to pay a publication charge, while maintaining the ability of Science to fulfill its mission of communicating groundbreaking research discoveries and illuminating the impact of research on society."

Green OA

Green OA comes with a different set of risks. Green OA relies on the continuing existence of subscription journals, yet requires those journals to give away their content. To balance the risk of lost subscriptions, most Green OA journals have an embargo period, a period of time that allows the journal exclusive rights to the article. This gives the journal a chance to earn some revenue before it opens up access to all. At the AMS, this revenue not only pays the costs of producing the journals, it also provides additional revenue for the AMS operating budget. For AMS journals, the embargo period is 5 years (although as described above, we work with authors whose funding prescribes shorter embargo periods). Default embargo lengths across all scientific journals seem to be 6 or 12 months.

Platinum OA

Platinum OA has seen some success in scenarios where funds are available to ensure continued publication of a journal with no charge to the author or reader. A successful example is seen in ACS Central Science¹⁷ from the American Chemical Society. It is unclear if this model can scale across societies, given that significant resources are needed to publish such a journal in perpetuity.

Copyright

The AMS offers Creative Commons licenses for its Gold OA journals (our Series B journals) of CC BY, or CC BY-NC.

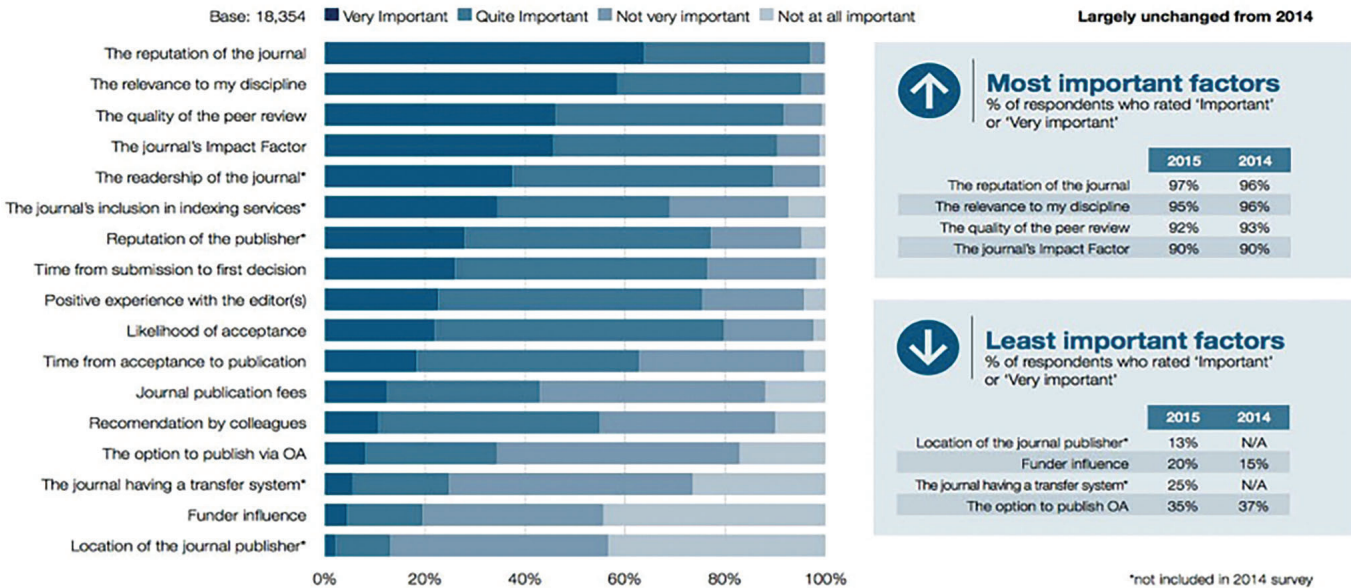
Most researchers are unaware that when publishing under a CC BY license they are giving away their intellectual property. When an author pays an APC, they are paying for a publisher to not only publish their article, but also allowing their content to be monetized in new ways, by both the chosen publisher, and also by other commercial entities, as long as there is attribution to the author, potentially at high prices. Indeed, it is unclear what recourse an author has if a commercial entity fails to credit content to the author. As artificial intelligence and machine learning tools grow more sophisticated, the ability to monetize content in new ways will be of increasing importance commercially.

Priorities of Researchers

Below are some of the results of a 2015 survey from *Nature*. This chart shows responses of science researchers in how they choose which journal to submit their article to. Top reasons are journal reputation and relevance, quality of peer review and impact factor. OA is fourth from the bottom.

In general, OA remains a low priority for most researchers, mathematicians included. In fact, one can make the argument that in mathematics—with virtually all

¹⁷<https://pubs.acs.org/page/acscii/about.html>



mathematical research existing on arXiv—we already have OA. This survey suggests that researchers are more likely to think of themselves as authors, rather than as readers. As authors, OA is not a primary concern.

Emerging Business Models

The forces behind the expansion of OA are economic. Library budgets are flat, if not declining. Commercial publishers must continually increase their earnings. In a flat economy, they can do this by acquiring more and more of the current market. This is why we're seeing so many mergers and acquisitions, such as Springer and Nature recently becoming one company. Gold OA publishing has become a priority for many of the larger publishers. Gold OA fits here because costs for launching a new journal, with significant APCs, mean that each article is paid for as it is published. There is no need to consider how to replace existing subscription revenues as these are new journals, and additional to the current market. Indeed, many of the larger commercial publishers are seeking other sources of revenue, such as with author workflow tools.

"Big Deals"

For many years, large commercial publishers have successfully engaged the market through "Big Deals." In these deals, libraries, groups of institutions and even countries subscribe to large packages of journals. These big deals offer significant discounts over a la carte journal subscriptions. Institutions have recently been pushing back on such deals because of their cost.

Transformative "Read and Publish" / "Publish and Read" Deals

Adding to the complexity of the sales environment for journals is the emergence of a new type of deal, reflecting the shift of many of the larger publishers to Gold and hybrid OA publishing. The deals are called "Read and Publish" (RAP) agreements, with a more recent iteration called "Publish and Read" (PAR). In such models, institutions pay a fee to a publisher to make all of their own authors' work immediately OA. The deals are based around agreed levels of APCs as well as access to reading the content.

RAP and PAR deals shift the economics—whereas the "Big Deals" sell journal content, these new arrangements are dependent on publishing OA articles and determining who pays for the APCs. RAP and PAR deals differ on whether the institution is paying primarily for its own authors' APC costs, or for the ability to access content.

While commercial publishers led the way on creating these deals, more transformative deals are appearing, e.g., from Cambridge University Press (publisher of 400+ journals) providing access to no-cost APCs for authors in a range of disciplines, including mathematics for many U.S. universities and colleges.

Some small to medium-sized societies are experimenting with transformative publishing deals. It is not possible for small publishers/societies to replicate the scale seen in larger publishers. Instead, societies are engaging in deals that base the cost to an institution on existing subscription payments plus a fee to allow publishing in that society's OA journals. This approach allows an institution's faculty to publish with no-cost APCs in that publisher's OA/hybrid OA journals.

For the AMS, this would mean that growth in revenues would no longer rely on subscription growth, but in the number of articles published OA, resulting in a higher fee to the institutions for faculty to publish OA. While this may be a model that the AMS could embrace, there are questions of sustainability and equity. Only wealthy institutions that can afford to participate in such deals will benefit from no-cost APCs for their faculty. This raises equity concerns in terms of the inability of mathematicians at smaller institutions to publish in OA journals, thus restricting their choice compared to researchers in wealthy institutions. In addition, it seems questionable whether larger institutions would be willing, long-term, to subsidize OA for global access.

The effect of moving to a RAP/PAR deal on the AMS may be profound, and a deep analysis of potential outcomes, both in terms of access and revenues would need to be undertaken.

Subscribe to Open

Another model for AMS to analyze is Subscribe to Open, initially developed by the non-profit publisher, Annual Reviews.¹⁸ It is designed to motivate collective action by libraries that are asked to continue to subscribe even though the content will be published OA. A 5% discount off the regular subscription price is offered to existing customers. If all current customers continue to subscribe, then that year's content is made available OA and all the back files are also made available OA. None of this content is opened if the number of subscribers decline, which discourages free riding. Libraries are not locked in to these arrangements, with a new arrangement negotiated annually. Any institutions that do not renew and that later return, do so at the list subscription price and do not receive the 5% discount. This model uses the conventional subscription process and existing library budgets, avoids the need to invest in transactional payment infrastructure, minimizes customer disruption by using routine library accounts payable processes, and avoids the prohibition some libraries face in paying for things that would otherwise be free.

Unfortunately, this model may not be sustainable. How many institutions, long-term, will be willing to subsidize OA to other institutions/researchers around the world? In addition, once subscriptions are lost, they would be hard to win back. Another complicating factor is that when a

¹⁸<https://www.annualreviews.org/>

journal is made OA in this model, there is no potential revenue growth to the journal as a publisher is unable to grow its subscriber base.

Politics of Open Access

Funders and Government

Another factor in the developing OA landscape is the role of funders, be they private or governmental. Funders in the U.S. are taking a different approach than funders in Europe, as noted above with the “Nelson Memorandum.”

As described in a recent Scholarly Kitchen article (Quantifying the Impact of the OSTP Policy, Chris Petrou, 13th September, 2022)¹⁹:

“The U.S. published 630k papers in 2021 according to the Web of Science, based on the affiliations of all authors on an article. The chart below shows how these papers can be narrowed down to those in scope of the OSTP policy (197k federally-funded papers), then those that are currently paywalled and will be affected by the policy (132k papers), and finally those that are likely to be published in a Gold-OA format (99k papers based on a working assumption that ¾ of papers will be published Gold-OA as a result of the policy).”

This assumption by Petrou reflects the prevailing publishing community view that the OSTP policy will drive papers to Gold OA, rather than Green OA.

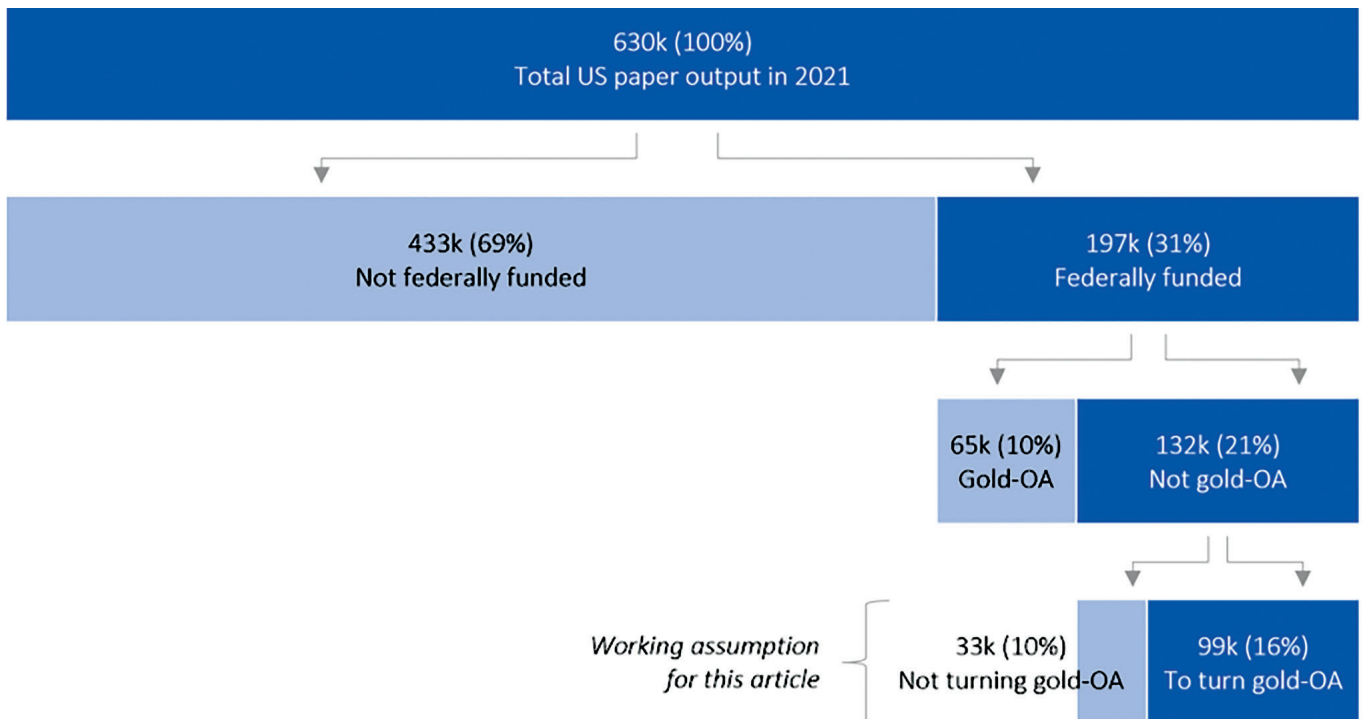
¹⁹ <https://scholarlykitchen.sspnet.org/2022/09/13/quest-post-quantifying-the-impact-of-the-ostp-policy/>

Europe

Europe is taking a different approach. The most recent and highly publicized funder initiative comes from a group of 16 funders in 13 countries called cOAlition S. This coalition has released a set of principles, called Plan S, for authors funded by any of the cOAlition S funders, which it intends to push forward as a mandate.

For the AMS, it is worth noting that 15% of articles published in AMS primary journals are funded by cOAlition S funders. The basics are as follows:

- **Open Access Journals or Open Access Platforms:** Authors publish in a Plan S compliant OA journal or on a Plan S compliant OA platform with a CC BY license.
- **Deposition of Scholarly Articles in Open Access Repositories:** Immediately upon publication, authors deposit the final published version of a scholarly publication (version of record), or an author’s accepted manuscript in a Plan S compliant repository. The document is immediately OA (with no embargo) under a CC BY license.
- **Transformative Agreements:** Authors publish OA with a CC BY license in a subscription journal that is covered by a transformative agreement that has a clear and time-specified commitment to a full OA transition.



U.S. paper output split by funding and OA status. Articles and Review Articles in 2021 per the Web of Science (SCIE, SSCI, AHCI, and ESCI indexes); all federal agencies with >1,000 papers and some with fewer papers were identified via the ‘Funding Agencies’ filter of the Web of Science.

Compliance with Plan S is quite complicated. The highlights are:

- The journal/platform must be registered in the Directory of Open Access Journals²⁰ (DOAJ) or in the process of being registered.
- All scholarly content must be openly accessible (journal website or dedicated platform), and free to read and download immediately upon publication, without any kind of technical or other form of obstacles.
- The journal/platform must enable authors to publish under a CC BY license.
- The journal/platform must offer authors/institutions the option of full copyright retention without any restrictions (i.e., no copyright transfer or license to publish that strips the author of essential rights).
- The journal/platform must have a solid system in place for review, according to the standards within the relevant discipline; and according to the Core Practices of the Committee on Publication Ethics²¹ (COPE), details on this must be openly available through the website.
- The journal/platform must provide automatic APC waivers for authors from low-income countries and discounts for authors from middle-income countries.
- The journal must not have a mirror/sister subscription journal with substantial overlap in editorial board to avoid business models charging for both access and publication. Such journals will de facto

be considered hybrid journals (see “Transformative Agreements” below).

- Transformative Agreements: cOAlition S acknowledges that some publishers have established mirror journals with one part being subscription based, and the other part being OA. Such journals are not compliant with Plan S unless they are a part of a transformative agreement (an agreement to eventually move a publisher’s entire journal portfolio to Gold OA) since they de facto lead to charging for both access and publishing in the same way as a hybrid journal does. Funding for publishing in such journals will only be supported under a transformative agreement. It is worth noting that AMS OA journals are defined by cOAlition S funders as “mirror” journals.

The chart below shows that the EU and the UK publish 50% of their papers in a Gold-OA format. Europe’s performance places it well ahead of the USA and China, which publish 30% and 33% of their content, respectively, in a Gold-OA format.

Reactions to Plan S

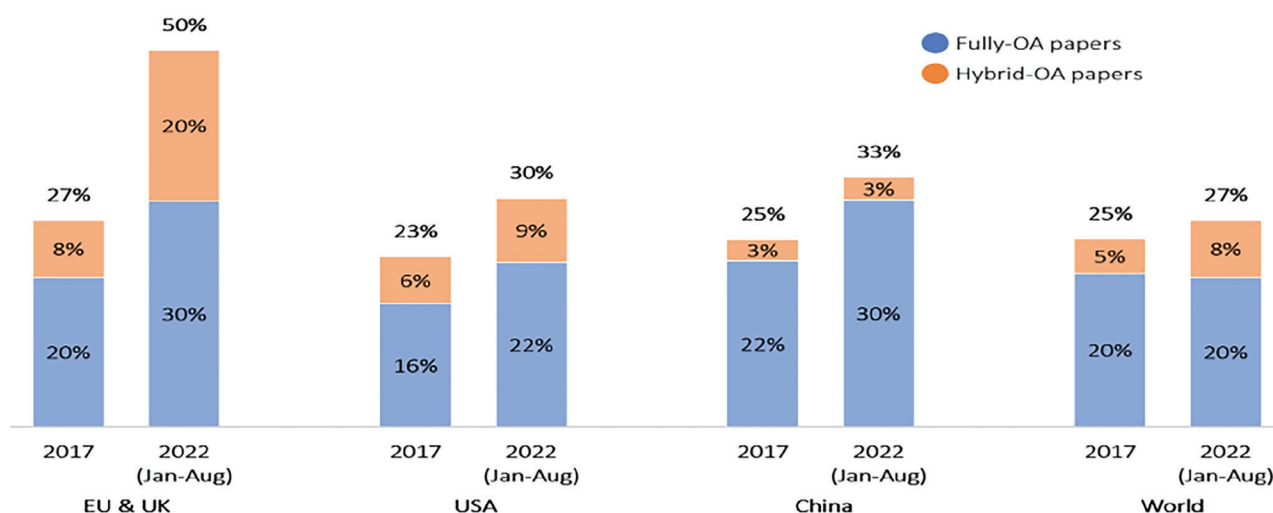
Looking further afield, a number of countries are expressing tacit support for Plan S. China and India, for example, are expressing public support for the European Plan S approach, yet there is little or no funding available to participate in such arrangements.

A recent proposal called Plan U has been suggested by the founders of bioRxiv,²² which is the biology equivalent to arXiv. This plan suggests that true OA could be achieved if funders mandate that all their funded researchers deposit their accepted manuscripts in the appropriate preprint repository—arXiv, bioRxiv, chemRxiv for example.

²⁰<https://doaj.org/>

²¹<https://publicationethics.org/core-practices>

²²<https://www.biorxiv.org/>



Gold-OA uptake by region. Articles and Review Articles per the Web of Science (SCIE, SSCI, AHCI, and ESCI indexes)

Summary

There is enormous complexity in the range of OA models available to researchers, funders, institutions, societies and publishers. Some are optional models and others are mandated.

Through the activities of Robert Harington (Associate Executive Director, Publishing), Karen Saxe (Associate Executive Director, Government Relations) and Catherine Roberts (Executive Director), the AMS will continue to engage in relevant discussions among funders, institutions, publishers, and researchers. Saxe and Harington have visited the OSTP multiple times for meetings on this issue. On behalf of the AMS and scholarly societies more broadly, Harington participated in the previous administration's OSTP roundtables on a potential zero embargo policy. Also planned are visits to the NSF to discuss the "Nelson Memorandum," and open publishing models in context of the discipline of mathematics. Harington is a board member of CHORUS, and is a "Chef" at the widely read publishing blog (6,000–8,000 daily readers) called The Scholarly Kitchen.²³ The AMS also participates in the Alliance for Open Scholarship²⁴ (All4OS), a cohort of societies and associations collaborating to identify, articulate and socialize open scholarship norms within their disciplines. The intent of these myriad efforts is to influence how funders, such as the NSF, interpret the "Nelson Memorandum," as they determine NSF public access policies, as well as to inform the mathematical community about important publishing developments, while ensuring the culture of mathematics is well-understood in the publishing world.

The range of OA initiatives that may be forced on society publishers clearly represents risk to AMS's ability to generate operating income. Many societies are feeling pressured to move into publishing arrangements with larger publishers in order to benefit from the economies of scale, infrastructure, and access to consortia benefits that only larger publishers currently provide.

For the AMS publishing program to remain financially healthy and independent, a balance of new and existing publishing models will need to be deployed that allow for compliance with federal public access mandates, as well as European open access funder mandates, while maintaining financial sustainability and access equity for all mathematicians.

For the AMS, it is worth remembering that in 2022 relatively few of our authors are directly funded by federal or cOAlition S funders.

The AMS position on OA is to take a balanced approach to journal publishing, while recognizing that whatever the AMS does, it needs to serve the mathematical community and ensure equity and inclusiveness in publishing scholarly

mathematical content. Whatever we do, we do not want to place the burden of public access (PA) or open access (OA) on individual researchers.

The AMS needs to take account of the inexorable drive towards openness, be it open research, open-source software development, and open access publishing models. In considering how to move forward, we need to take account of the AMS mission, the nature of mathematical research and the cultural differences between math and other disciplines, as well as perceptions among mathematicians in the U.S. and beyond.

The AMS should place equity at the core of its approach to PA and OA models. Of primary importance is to develop models that do not place existing publishing revenue streams at risk. Perhaps the most interesting response to the "Nelson Memorandum" is from *Science*, described earlier. The AMS already offers immediate Green OA on final, peer-reviewed author manuscripts. While there is clearly risk to subscriptions with this model, it may be that this approach reflects best an AMS balanced approach to complying with funder PA and OA mandates.

The AMS should continue to explore appropriate OA business models, while maintaining subscription models as appropriate for a balanced offering that provides options for all authors—funded, or not funded. Further analysis of a range of OA model scenarios will need to be performed, including Gold OA models such as transformative arrangements, Subscribe to Open, and other models such as Diamond OA journals seen in the new AMS flagship journal, *Communications of the American Mathematical Society*.

Glossary of Terms

APC – Article Processing Charge.

arXiv – A repository of electronic preprints (known as e-prints) approved for posting after moderation, but not full peer review. In many fields of mathematics and physics, almost all scientific papers are self-archived on the arXiv repository.

Big Deal – Pricing deal offered to libraries for subscriptions to a large set of journals, typically from large commercial publishers.

bioRxiv – A free submission, distribution and archive service for unpublished preprints in the life sciences.

chemRxiv – A free submission, distribution and archive service for unpublished preprints in chemistry and related areas.

CHORUS – Clearing House for the Open Research of the United States (it is also international now).

cOAlition S/Plan S – cOAlition S funders have proposed that "By 2020 scientific publications that result from research funded by public grants provided by participating national and European research councils and funding

²³<https://scholarlykitchen.sspnet.org/>

²⁴<https://www.all4os.org/>

bodies, must be published in compliant Open Access Journals or on compliant Open Access Platforms.” Whether or not this will become a formal mandate is yet to be determined.

Content Repository – A content repository or content store is a database of digital content with an associated set of data management, search and access methods allowing application-independent access to the content, rather like a digital library, but with the ability to store and modify content in addition to searching and retrieving. Examples include Funder repositories (e.g., NSF-PAR, and institutional repositories such as Deep Blue at the University of Michigan, and DSpace at MIT).

COPE – Committee on Publication Ethics

Creative Commons Copyright Licenses

CC BY – this license lets others distribute, remix, tweak, and build upon your work, even commercially, as long as they credit you for the original creation.

CC BY-NC – this license lets others remix, tweak, and build upon your work non-commercially, and although their new works must also acknowledge you and be non-commercial, they don’t have to license their derivative works on the same terms.

CC BY-NC-ND – this license is the most restrictive of the six main licenses, only allowing others to download your works and share them with others as long as they credit you, but they cannot change them or use them commercially.

DOE – United States Department of Energy.

DOI – A unique and persistent string of characters used to identify a journal article, website, or other item of intellectual property, typically one in digital form.

Embargo Period – The amount of time articles are kept behind a paywall prior to becoming open access.

Hybrid Journal – a subscription journal where select articles are made openly available through an APC.

Mirror Journal – A “mirror” journal shares the same editorial board as a traditional subscription model journal but is itself a separate, Gold OA publication.

NSF – National Science Foundation.

NSF-PAR – NSF/DOE – central article/data repository.

OA – Open Access

Gold OA articles – (versions of record) freely available to the reader because the author has paid an article processing charge (APC).

Green OA – articles freely available at no cost to the author or reader. This can happen when the author deposits the article (most often the accepted manuscript)

in an external repository or when the article (version of record) becomes open in the online version of the journal after a time delay known as an embargo period.

Diamond/Platinum OA – articles (version of record) available freely at no cost to the author or reader, with no time delay. These journals tend to be small ones with private grant funding or financial support from their host institution or library.

OSTP – Office of Science and Technology Policy, an office in the White House.

PAR – Publish and Read agreement. With PAR, a consortium pays a pre-agreed amount for papers published by affiliated authors, and everyone in the library/consortium gets access to the subscription content for no extra cost. The recently announced agreement between Wiley and Projekt DEAL in Germany is an example.

Paywall – an arrangement whereby access is restricted to users who have paid to subscribe to the site.

Preprint – a version of a scholarly or scientific paper that precedes formal peer review and publication in a peer-reviewed scholarly or scientific journal. The preprint may be available, often as a non-typeset version available free, before and/or after a paper is published in a journal.

RAP – Read and Publish agreement. The amount of money currently paid to the publisher (for subscriptions and sometimes also for APCs where there has been additional funding for OA publishing) is guaranteed, and in exchange authors can publish OA without paying an additional APC. In some instances—for example where a country publishes many articles with a publisher or there is strong article submission growth to the publisher from authors in the country—additional money is made available. Consortia sometimes cap the total number of articles for which they will pay in order to control costs.

Subscribe to Open – a new OA publishing model from the non-profit publisher, Annual Reviews. It is designed to motivate collective action by libraries who are asked to continue to subscribe even though the content will be published OA.

Version of Record – the final typeset and edited version of the journal article that has been made available by the publisher by formally and exclusively declaring the article “published.”