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Decolonizing Open Access in Development Research

Journal Open Access and Plan S: Solving Problems or Shifting Burdens?

Shina Caroline Lynn Kamerlin, David J. Allen, Bas de Bruin, Etienne Derat and Henrik Urdal

ABSTRACT

This academic thought piece provides an overview of the history of, and current trends in, publishing practices in the scientific fields known to the authors (chemical sciences, social sciences and humanities), as well as a discussion of how open access mandates such as Plan S from cOAlition S will affect these practices. It begins by summarizing the evolution of scientific publishing, in particular how it was shaped by the learned societies, and highlights how important quality assurance and scientific management mechanisms are being challenged by the recent introduction of ever more stringent open access mandates. The authors then discuss the various reactions of the researcher community to the introduction of Plan S, and elucidate a number of concerns: that it will push researchers towards a pay-to-publish system which will inevitably create new divisions between those who can afford to get their research published and those who cannot; that it will disrupt collaboration between researchers on the different sides of cOAlition S funding; and that it will have an impact on academic freedom of research and publishing. The authors analyse the dissemination of, and responses to, an open letter distributed and signed in reaction to the introduction of Plan S, before concluding with some thoughts on the potential for evolution of open access in scientific publishing.

INTRODUCTION

In September 2018, a coalition of European funding agencies launched a new initiative, 'cOAlition S', which stood behind a new plan, 'Plan S', with

We would like to thank our peers and colleagues for valuable discussion on the topic of Open Science in our respective disciplines, as well as Open Science and scholarly communication in general, which contributed significantly to shaping our thoughts during the preparation of this paper. We would also like to thank Dr Irmeli Barkefors for her assistance in editing the manuscript.

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the goal of ensuring that 'from 2021, scientific publications that result from research funded by public grants must be published in compliant Open Access journals or platforms' (cOAlition S, 2018a).

We support many of the principles of open research. However, building on our own positions as academic researchers and our experience of academic publishing, we believe that there are serious problems with Plan S as it is currently proposed, even after the revised implementation guidelines released by cOAlition S on 31 May 2019 (see cOAlition S, 2020). What we have seen so far from the implementation process also raises concerns about the potential lack of political will to make the financial and operational commitments necessary to sufficiently mitigate the worst effects of the Plan.

From our different disciplinary and geographical perspectives, the authors of this essay have been vocal in raising these concerns and have made contributions to national and international debates on Plan S. In order to share concerns about the implications of Plan S, initially focusing on the situation of the chemistry community, two of the authors (B. de Bruin and S.C.L. Kamerlin, with support and assistance from E. Derat) coordinated an Open Letter detailing our reactions, as researchers, to the Plan (de Bruin and Kamerlin, 2018a). The letter proved to be relatable to researchers beyond this initial disciplinary remit, however, and at the time of writing this contribution (October 2020), it has ∼1,800 signatures from a broad range of disciplines (de Bruin and Kamerlin, 2018c). Similarly, the Peace Research Institute Oslo (PRIO), from which the other two authors (D.J. Allen and H. Urdal) hail, has taken two initiatives: to produce an extensive report in collaboration with colleagues at the University of Oslo on the possible implications of Plan S for scholarly publishing (Carling et al., 2018); and to post a petition demanding that the Norwegian government conduct a proper impact assessment of the Research Council of Norway's commitment to Plan S (PRIO, n.d.). The latter has been signed by over 1,100 researchers across disciplines in Norway.

In this academic thought piece, we will build on these existing engagements and clarify our continuing concern in the face of the impending implementation of Plan S. In order to do this, we will begin by providing a brief overview of valuable features of the currently prevailing publishing system common to the social and chemical sciences that we have reason to believe are put under considerable strain by Plan S. We will then proceed to project our expectations about how Plan S will affect these current modes of scholarly communication within our disciplines and to clarify why we feel this is a cause for considerable concern on the part of the research community. We will particularly focus on the effects of Plan S on collaboration and academic freedom, and the expected rise in publication costs facing authors. We will take a closer look at our Open Letter and its aftermath, as the response to the Open Letter is illustrative of the extent to which our concerns resonate with a broad cross-section of the scholarly community, well beyond the publication cultures of chemistry as a discipline and even natural sciences as a

whole. Finally, we will consider more recent developments, specifically the revision of the implementation guidelines for Plan S and the initial steps towards implementation that are now being taken, and comment on how these relate to our concerns.

THE RISE OF OPEN ACCESS PUBLISHING

The Value of Journals for Scholarly Communication

Whilst recognizing that no system is perfect, we believe that the current system of scholarly publishing has a number of positive features that have served the academic community well. In this section, we highlight three of these contributions.

Journals as Hubs of Communication and Community

The history of scholarly publication can be traced back to Theophrastus in Greece (Theophrastus, 1916) and to Pliny the Elder in Rome, with the opus magnus *Naturalis Historia* (Pliny, 1860); but also to ancient China and to Wei Boyang, who was the first author to write down the recipe for gunpowder (Yoke, 2000: 180–83). The common point between them is the fact that their texts were kept in rare libraries, and were not accessible to a wide audience (Harris, 1999: 69–162). With the diffusion of printing, more people became able to access written knowledge, which led to the introduction of what we now call 'newspapers', such as *La Gazette* in France in 1631,[1] or the *Mercurius Aulicus* in England in 1643 (Varley, 1948). The same movement touched the academic world in 1665, with the introduction of the first scientific journal, *Philosophical Transactions of the Royal Society* (Oldenburg, 1667). This was a tremendous breakthrough, as prior to the appearance of these early publications, scientific knowledge was being shared through letter correspondence, as well as self-published books and pamphlets (Mack, 2015), with undesirable consequences. For example, Newton had already discovered Calculus in the late 1600s, but this work was only disseminated to a broader audience 65 years later, in 1736 (Newton, 1736). Specialized academic journals, as a means of organizing scholarly communication and exchange, have been instrumental in facilitating the emergence of internationally interconnected, specialized scholarly communities. Even in humanities disciplines, where monographs still play a significant role, journal publishing is absolutely central to academic life (Finn, 2019). For researchers, journal publishing is thus intimately bound up with the endeavour to secure

1. See the Bibliothèque Nationale de France, 'Recveil des Gazettes de l'Année 1631', La Gazette, *4-LC2-1*: gallica.bnf.fr/ark:/12148/bpt6k106358h (accessed 19 October 2020).

an appropriate audience for one's research, but also with belonging and contributing to a scientific community that fosters the establishment of codes for scientific conduct, professionalism and training in publication practices, and quality assurance.

Journals and Research Quality

Publishing in high-quality journals is important for researchers. The reputation and standing of these journals have little to do with simple impact-factor counting. Rather, if certain journals are especially well respected, it is because it is difficult to get an article accepted in these journals. This is not due to exclusionary personal preferences on the part of the editors, but because the peer review process is strict and selective for quality, relevance, novelty and important new insights.

To provide an example of the evaluation process in these journals (which is surprisingly similar across disciplines): when a manuscript is first submitted, it is read by a specialized team and, if they find it suitable for the journal, an associate editor is assigned to the manuscript. This editor (often a leading researcher in the relevant field) will read and distribute the manuscript to typically between two and four referees. These referees will either recommend acceptance, ask for minor modifications (mostly rewriting), major modifications (for example, asking for new data collection or analysis), or advise to reject the article. In case of major modifications, the manuscript will be reviewed again after the second submission, either by the same referees, or by new ones if the associate editor feels the need for that. In some cases, multiple rounds of review might be necessary.

Publication in high-quality journals is thus a rigorous process with multiple checks and balances in place to ensure the academic quality of the articles published. It relies on good knowledge of the referees' capacities, a clear vision of what academic quality is and a proper calibration of journal choice. While journal-based peer review, in its current form, is a relatively new development (Baldwin, 2018), it has become utterly integral to the proper functioning of the scientific enterprise, and remains the primary mechanism through which research communities control and amplify the quality of their own outputs.

Journals as Researcher-driven Enterprises

Plan S advocates have repeatedly placed heavy emphasis on the association between traditional journals and the multinational, for-profit publishing houses that publish many academic journals. However, while the role of publishers is clearly one part of the picture, this focus obscures the important fact that journals are, in their core functions, *researcher-driven* enterprises.

The work of curating, selecting and editing scholarly content, as well as the vital function of peer review, is conducted by researchers, and it is usual for editorial committees, made up of researchers, to have a strong sense of responsibility for and ownership of their journal.

In some cases, this sense of ownership and responsibility is in fact reflected in the formal ownership structure of the journal. We are thinking here of so-called *society journals*, which are owned, and in some cases also directly published, by learned societies or research institutions. Society journals are amongst some of the most well-respected academic journals in a number of fields.

Society journals play a particularly central role in the field of chemistry. This has long been the case: one major milestone for our field was the formation of the Chemical Society of London in 1841 (now called the Royal Society of Chemistry, RSC).[2] This idea was so fruitful that it led to the creation of similar societies in other countries — France in 1857,[3] Germany in 1867,[4] and Japan in 1878,[5] to mention just a few. These societies soon spawned their own journals, allowing members to exchange data and new concepts in an organized fashion. For example, the *Journal of the Chemical Society* was founded in 1862 (Royal Society of Chemistry, 1862) and it can be considered that *Chemical Communications* now edited by RSC is pursuing the spirit of this journal. On the other side of the Atlantic, the American Chemical Society (ACS) was founded in 1876[6] and has been editing its flagship journal since 1879 (named the *Journal of the American Chemical Society*, but referred to by all chemists as *JACS*). In Germany, the main journal in chemistry is *Angewandte Chemie International Edition* (*ACIE*), in existence since 1888 (Gölitz, 1988); it is now published by a private company (Wiley-Blackwell), but its editorial board is under the control of the German Chemical Society (Gesellschaft Deutscher Chemiker — GDCh). While new major journals in chemistry have emerged as electronic communication allows for more diversity (for instance *Nature Chemistry*, *Chem*, *Chemical Science* and *ACS Central Science*), publishing an article in *JACS* or *ACIE* is still considered a great achievement for a chemist and is duly celebrated in her or his lab.

Society- and researcher-owned journals are also important in the social sciences, although it is less common than in the hard sciences for research

2. Royal Society of Chemistry, 'Our Origins': www.rsc.org/about-us/our-history/our-origins (accessed 14 October 2020).
3. Société Chimique de France, 'Présentation': www.societechimiquedefrance.fr/Presentation-1.html?lang=fr (accessed 14 October 2020).
4. Gesellschaft Deutscher Chemiker, 'Über uns, unsere Leitbilder und unsere Geschichte': www.gdch.de/gdch/ueber-uns.html (accessed 14 October 2020).
5. Chemical Society of Japan, 'About the CSJ': www.csj.jp/csj-en/about/about.html (accessed 14 October 2020).
6. American Chemical Society, 'About ACS': www.acs.org/content/acs/en/about.html (accessed 14 October 2020).

communities to manage the entire publishing process (Wise and Estelle, 2019). To take three examples close to home, PRIO owns and runs the editorial offices of two internationally respected social science journals, the *Journal of Peace Research* and *Security Dialogue*, both of which have been running without interruption for more than five decades. The journals cater to different communities within international relations and political science and depend on contributions from a large and dedicated global network of editors, authors and referees. Both journals are highly regarded for their rigorous editorial processes leading to the publication of top-quality scientific contributions — something that is also reflected in consistently high rankings on citation indexes. The same can also be said of *Development and Change*, which is hosting this collection; one of the oldest and most respected development studies journals, it was founded and is still owned by the International Institute of Social Studies in The Netherlands.

Open Access Mandates and their Impact on Scholarly Publishing

Plan S has caused shockwaves in the research community, in part because it is one of the most comprehensive and restrictive open access (OA) mandates to date — indeed, the prominent OA commentator, Richard Poynder, has described Plan S as 'the *non plus ultra* of coercive OA mandates' (Poynder, 2019). However, it is far from being the first, and such mandates have by now become well-established (Schmidt and Kuchma, 2012) at both the institutional and funder levels, with many institutions and funders already requiring scientists to deposit their articles in openly accessible repositories. For illustration, every single one of a broad range of national, European and international funders that fund or have funded the work of the authors of this article now has some form of open access mandate in place. In the UK, 70 per cent of research funders included in the higher education digital services agency Jisc's Sherpa Juliet funder policy database require publications resulting from research they fund to be archived in an open institutional repository; 29 per cent require (and 40 per cent encourage) that the version of record be published open access in a gold OA or hybrid journal.[7]

Clearly, these mandates have had a significant impact on how manuscripts are shared within research communities. In chemistry, the Public Access policy of the National Institutes of Health (NIH)[8] has had a particularly strong impact, driving chemistry journals to accept both green open access

7. Sherpa Juliet, 'Juliet Statistics': v2.sherpa.ac.uk/view/funder_visualisations/1.html (accessed 19 October 2020).
8. The policy reads: 'Peer-reviewed manuscripts upon acceptance for publication, to be made publicly available no later than 12 months after the official date of publication: Provided, that the NIH shall implement the public access policy in a manner consistent with copyright law'. See US Department of Health and Human Services, publicaccess.nih.gov/policy.htm (accessed 19 October 2020).

(with embargo), hybrid open access, and immediate (gold) open access, typically (but not exclusively) upon payment of an article processing charge (APC). For example, as of June 2019, all ACS journals offer some form of OA option, either through full paid gold (*ACS Omega*), diamond/platinum open access (*ACS Central Science*) or the hybrid 'Authors Choice' route (all other journals). Publication fees range from US$ 1,250 (*ACS Omega*) to US$ 4,000 (for immediate OA at all other ACS journals, except *ACS Central Science*), with a US$ 1,000 add-on for a Creative Commons CC-BY license (all journals except *ACS Central Science* and *ACS Omega*), and with member, affiliation or country discounts, or a combination thereof, dependent on the specific journal.[9] Similar patterns can also be seen at the RSC,[10] GDCh/ChemPubSoc,[11] and the Royal Society,[12] including dedicated OA journals at all these society publishers, while the Beilstein journals (published and funded by the non-profit Beilstein Institute) are both free to read and free to publish under a platinum model.

The increase in open access mandates has led to many positive outcomes: investment in dedicated repositories such as PubMed Central, Europe PMC and other national and pan-European repositories facilitating the easy sharing and dissemination of OA (versions of) published manuscripts; increased flexibility in licensing options at scholarly journals; as well as greater flexibility not just *because* work is made open access, but also *how* it is made open access, while simultaneously complying with journal publishing guidelines. The downside, however, has been that the majority of this transition has been towards an author-pays APC-based model, with APCs easily reaching several thousands of euros or dollars for most of the flagship journals.[13]

One way to circumvent this drift towards a pay-to-play publishing system, while still fostering a move towards greater open access to research publications, would be to encourage green OA models of the kind promoted by the NIH, which require archiving of the author accepted manuscript in an open repository (for example PubMed Central) with a maximum embargo of 12 months. In contrast, the short (or, in the case of Plan S, non-existent) embargo periods allowed in many OA mandates essentially enforce a push towards paid gold as the only means of compliance, as most publishers are

9. For updated full pricing details as of mid-October 2020, see ACS Publications, 'Open Access Pricing': acsopenscience.org/open-access/pricing (accessed 14 October 2020).
10. Royal Society of Chemistry, 'Article Processing Charges (APCs)': www.rsc.org/journals-books-databases/open-access/gold-open-access/#apc (accessed 14 October 2020).
11. Wiley, 'Article Publication Charges (APCs)': authorservices.wiley.com/author-resources/Journal-Authors/open-access/article-publication-charges.html (accessed 14 October 2020).
12. The Royal Society, 'Open Access Publishing': royalsociety.org/journals/authors/which-journal/open-access (accessed 14 October 2020).
13. For an overview of prices, see University of Cambridge (2018); also see Open APC, 'Open APC Initiative': treemaps.intact-project.org/apcdata/openapc (accessed 14 October 2020).

hesitant to eliminate or drastically reduce journal embargo periods, fearing that this will undercut front-list subscription sales and thereby render many journals financially unsustainable. This push towards pay-to-publish is coupled with the emergence of APC-based (and mostly for-profit) pure open access publishers, such as BioMed Central, Hindawi, MDPI, Frontiers, and the non-profit PLoS, all of which have engaged in repeated APC cost hikes in recent years (Morrison, 2018a, 2018b, 2018c, 2019; Pashaei and Morrison, 2019), as have the society publishers.

When these constant price hikes are coupled with researcher insensitivity to price (which in turn is driven by the fact that researchers choose publication venue based on other non-cost-related factors such as journal scope, expected readership of the journal, and journal quality), this runs the risk of creating APC hyperinflation that can overshadow current (legitimate) concerns about the serials crisis in subscription prices (Yong-Seng Khoo, 2019). In addition, at a time of hypercompetition for research grants and strained research budgets, such APCs can cause a tremendous burden for researchers. For example, research grants in the Netherlands typically cover approximately € 40,000 for consumables over a period of four years per graduate student. If he/she publishes five research articles (not uncommon) with an APC of € 5,000 each (see above), that amounts to spending more than 50 per cent of the total budget for consumables on APCs alone, leaving very little money for other research-related costs, whether lab equipment or data collection.

There are some moves to reduce the APC burden. These include country-based waivers of APCs (as currently implemented by, for example, the ACS, RSC, the American Institute of Physics, AIP, the Royal Society, and Wiley,[14] among many other publishers); pre-paid voucher schemes as again offered by many institutions through various publishers; read-and-publish/publish-and-read type agreements (Johnson, 2019); or block grants such as in the case of UK Research & Innovation (UKRI, formerly RCUK).[15] However, in our experience, in many cases the burden of publishing costs falls on the researchers themselves as an eligible cost on the grant, and no new funds are made available to cover the cost of publishing. This significantly

14. See, respectively: ACS, 'About ACS Author Choice': pubs.acs.org/page/policy/authorchoice/index.html (accessed 19 October 2020); RSC, 'Gold Open Access: Free and Permanent Unrestricted Online Access to Your Research': www.rsc.org/journals-books-databases/open-access/gold-open-access/#discounts (accessed 19 October 2020); AIP Advances, 'Publication Charges': aip.scitation.org/adv/authors/waiver (accessed 19 October 2020); Royal Society Open Science, 'Article Processing Charge Waivers': royalsocietypublishing.org/rsos/waivers (accessed 19 October 2020); Wiley, 'Waivers and Discounts': authorservices.wiley.com/open-research/open-access/for-authors/waivers-and-discounts.html (accessed 19 October 2020).
15. UK Research & Innovation, 'Open Access Block Grants': www.ukri.org/funding/information-for-award-holders/open-access/open-access-policy/open-access-block-grants (accessed 19 October 2020).

reduces already strained research budgets, and limits the scholarly activities of researchers, redirecting funds towards dissemination of existing research rather than the generation of new research.

We note that the Plan S implementation language is sufficiently elusive on this front that the risk of the same happening under Plan S clearly exists. This creates countless problems for researchers.

1. It creates financial hierarchies, in which only the best-funded researchers and/or institutions can afford to publish in desirable journals (where 'desirable' is not necessarily high impact, but rather based on journal reputation and standing in the field). This has a negative knock-on effect on researcher evaluation and subsequent ability to secure funding.
2. It disenfranchises researchers with less access to funding from being able to select for themselves where they want to publish their research, with publishing decisions becoming limited by whether researchers can afford to pay APCs. This particularly impacts researchers from less affluent countries/institutions, including scholars in the global South. While these effects can be mitigated to some extent by waivers and country discounts, it is important to remember that individual researcher funding levels even within a nominally affluent country (for example, one that does not fall under waiver schemes) can vary widely, and when the burden of payment is placed on individual researchers, this has significant negative impact on their publishing ability. Relying on waivers as a mechanism to de facto outsource the policing of equal access to publication, renders the publishing of works by researchers from less affluent institutions and countries vulnerable to potential uneven, untransparent and predatory behaviour among journals and publishers.
3. The pay-to-publish model suffers from an inbuilt conflict of interest, where even the most well-meaning publishers will be faced with the dilemma of deciding whether to publish as many articles as possible, thus increasing APC revenue, or to remain selective but to drive up the price of the APC, as can be seen from the ever-increasing cost of APCs at selective journals (University of Cambridge, 2018).

Thus, overly rigorous mandates that inadvertently push researchers into pay-to-publish open access models can cause tremendous financial burdens on researchers, while stratifying the research community and disenfranchising researchers without access to substantial publication funds.

In light of this, it is perhaps not surprising that there are major issues in terms of compliance with such mandates; depending on discipline and funder, compliance rates range from as high as 90 per cent for NIH, to as low as 23 per cent for the Social Sciences and Humanities Research Council of Canada (Larivière and Sugimoto, 2018; see also Borrego, 2015; Khalife,

2018; Pontika and Rozenberga, 2015; Vincent-Lamarre et al., 2016; Winter, 2019, among others). The obvious question, therefore, is how such mandates can be framed to facilitate open access, with high compliance levels, while not imposing unreasonable burdens of cost on individual researchers. Clearly, here, the NIH Public Access model performs very well as a high-compliance strategy to make research articles available to the general public without placing an unnecessary burden of cost on researchers or libraries.

Preprints Finally Expand beyond the arXiv

The use of preprints has been an important part of science publishing for nearly three decades: the arXiv open access repository was started in 1991, during the early consumer development of the internet, initially serving physics;[16] other subject areas have been slow on the uptake of this kind of publishing. For example, it is only recently that all major chemistry journals have finally allowed the use of preprint servers without considering this to be a form of prepublication.[17] However, preprints have finally made their way into the research community, and many if not most disciplines have their own dedicated preprint repositories, such as ChemRxiv for Chemistry, bioRxiv for life sciences, SocArXiv for the social sciences, medRxiv for the health sciences, and so forth.[18] Clearly, preprint servers are an efficient (and cost-effective) way to make knowledge freely available as fast as possible, while bypassing the cost challenges involved in an APC-based pay-to-publish system. Reinforcing such servers by providing them with resources to ensure their durability, while pushing journal editors to release publications after a reasonable embargo period, is thus perhaps the best path to follow to achieve open access publication while avoiding expensive APCs for the whole community.

PLAN S: OUR REACTIONS AND RESPONSE

Once we became aware of Plan S, as academic researchers and actively involved in researcher support, we became extremely worried about the impact this plan would have on the future of scholarly communication. Below, we summarize our main concerns with Plan S, as outlined by some of the authors elsewhere (Derat et al., 2018).

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16. arXiv, 'General Information about arXiv': arxiv.org/help/general (accessed 19 October 2020).
17. See the Twitter feed: twitter.com/j_a_c_s/status/1031300824889208833?lang=fr (accessed 19 October 2020).
18. For a detailed discussion of the current use of preprint services, see, e.g., Knowledge Exchange (2019).

Concerns over the Increasing Costs to Authors of a Paid Gold Model of Publishing

The stated goal of cOAlition S is to abolish the subscription-based model of publishing.[19] What some have dubbed 'the affordability problem' (Poynder, 2019) — the problems caused by the exorbitant and rising costs of journal subscriptions as a mode of research dissemination — lies at the heart of this scepticism towards the subscription model.

However, given constant APC price hikes, we expect a fully paid gold landscape to lead to a massive increase in the costs of publishing for authors, as each article published individually will cost several thousand euros or dollars.[20] Shifting the burden of the cost of scholarly communication onto individual researchers and their project budgets is a non-negligible negative by-product of the attempt to reduce costs in the research system as a whole. The revised Plan S implementation guidelines (cOAlition S, 2019a) do not go into detail about how these runaway costs for researchers will be addressed, nor how the costs will be paid and who will pay them (a separate budget for publications where researchers can directly bill the funding agencies? eligible costs on the grant?). The Research Council of Norway, one of the protagonists of Plan S, has devised a model whereby publishing costs are eventually to be baked into the hourly rates charged by research institutions in grant proposals submitted to this funder (Research Council of Norway, 2019). The coverage of APCs is an area in which it will likely be challenging to achieve harmonization across funders and countries, potentially hampering international collaboration. In any case, if these costs are to be author-facing, it means reduced funding for research unless funding agency budgets are increased significantly. The initial discussion of maximum caps on APCs, that would severely limit the competition between journals to deliver high-quality services, has wisely been removed from the revised guidelines (cOAlition S, 2019a), but it is unclear what measures will replace it.

The revised guidelines nod towards the benefits of diamond/platinum open access, and this recognition of the need to avoid shifting the burden of publishing costs onto researchers is to be welcomed. However, once again, no sufficiently concrete path to achieving it is provided. The closest we come to a response to this issue is the revision allowing hybrid open access if a journal is part of a transformative agreement. Again, these agreements are to be welcomed, as they are a way to release some of the pressure on researchers by avoiding author-facing charges and facilitating continued

19. 'There is no longer any justification for this state of affairs to prevail and the subscription-based model of scientific publishing, including its so-called "hybrid" variants, should therefore be terminated' (cOAlition S, 2018b: 1).
20. Again, for an example of current price distribution of APC, see University of Cambridge (2018). Note that these prices have increased substantially in the past 10 years (Morrison, 2018a, 2018b, 2018c, 2019; Pashaei and Morrison, 2019).

publishing in established, high-quality journals. This is essential given the documented lack of high-quality open access journals in many disciplines, especially in the humanities and social sciences (see, e.g., Carling et al., 2018; Kramer and Bosman, 2019). Nonetheless, there are substantial unresolved issues about the distribution of costs from and the financial sustainability of access to these agreements. In Norway, for example, there is ongoing concern from private non-profit research institutes like PRIO, which are particularly vulnerable to the policies of funding agencies, that participation in transformative agreements will be prohibitively expensive for all but the largest universities (Trædal, 2020).

Finally, the revised guidelines still put such severe restrictions on green OA that in practice the only way to fulfil them, if not publishing in a fully open access journal, would be to pay the APC and very likely to also have to pay for a Creative Commons license (with the ACS, for example, charging US$ 1,000 for the license alone[21]). This will create tremendous inequalities in research. Although the revised implementation guidelines mention the San Francisco Declaration on Research Assessment (DORA)[22] explicitly, there are already entrenched hierarchies among fully open access journals, with cost of publication largely trailing impact factor and/or perceived desirability of publishing in those journals, which is a major potential source of inequity in publication (Kramer and Bosman, 2018). The many problems associated with a transition to a pay-to-publish model have already been discussed above.

The Impact on Scholarly Communication across Borders, and on Researcher Mobility

At the time of writing, membership of cOAlition S comprises one European funder (the European Commission),[23] 17 national funders and seven charitable foundations (following the withdrawal of Riksbankens Jubileumsfond[24]). This covers only a small fraction of global research output which, according to the Nature Index ranking of country outputs, is still

21. American Chemical Society, 'Open Access Pricing': acsopenscience.org/open-access/pricing (accessed 19 October 2020).
22. Quoting from its website: DORA 'recognizes the need to improve the ways in which the outputs of scholarly research are evaluated. … It has become a worldwide initiative covering all scholarly disciplines and all key stakeholders including funders, publishers, professional societies, institutions, and researchers' (see: https://sfdora.org).
23. The European Research Council withdrew its support in July 2020; see the press release from the ERC: https://erc.europa.eu/news/erc-scientific-council-calls-open-access-plans-respect-researchers-needs (accessed 4 November 2020).
24. See the press release from Riksbankens Jubileumsfond of March 2019, 'RJ Ställder Sig Vid Sidan av Plan S': www.rj.se/debattinlagg/2019/rj-staller-sig-vid-sidan-av-plan-s (accessed 19 October 2020).

dominated by the United States, China and Germany. Neither China nor Germany is represented in cOAlition S, and the United States is represented by three charitable/non-profit organizations: the Gates Foundation, the Howard Hughes Medical Institute, and the Templeton World Charity Foundation.[25] This is a single-digit increase (primarily accounted for by charitable organizations) over the number of funders represented at the initial launch of cOAlition S in September 2018, and in fact, in a recent interview (AIP, 2019), the director of the White House Office of Science and Technology Policy (OSTP), Kelvin Droegemeier, effectively ruled out the involvement of US federal funders in cOAlition S, although the OSTP is currently reviewing its public access policy (US National Archives, 2019). In addition, within the European landscape, the continued absence from participation of major European players such as Germany and Switzerland does not set a strong precedent for further expansion of cOAlition S. Some have even argued that the share of global research publishing accounted for by cOAlition S publishers is decreasing, with 'an annual growth rate of articles funded by cOAlition S of somewhere between 3–4%', but in the context of a '6% growth rate expected … for the research article market as a whole' in the year following the launch of the Plan (Inchcoombe, 2019).

This immediately creates two parallel systems, in which researchers from outside cOAlition S (who still constitute the vast majority of global research) will have full freedom of choice in selecting outlets through which to disseminate their research, whereas researchers funded by the minority cOAlition S funders will face severe restrictions in their choice of publication venues. As cOAlition S has made it clear that, in cross-funder collaborations, it will be Plan S rules that apply,[26] this will mean that researchers financially supported by cOAlition S funders will need to make tough decisions about whether they place greater value on the collaboration or on their freedom of choice of publication venue. There is a very real risk that this disparity will lead to broken collaborations and reluctance to begin new ones.

Similarly, if cOAlition S funders and the rest of the world mandate different publication channels and use very different evaluation systems for researchers, this will impact the mobility of researchers from cOAlition S countries, with a particularly negative impact likely for early career researchers (Herschberg et al., 2018). This may reduce their ability to secure

25. 'Nature Index': www.natureindex.com/country-outputs/generate/All/global/All/score (accessed 19 October 2020).
26. 'cOAlition S recognises that funders may face the challenge of scholarly papers published in collaboration with authors funded by non-cOAlition S members, or by authors with mixed affiliations. cOAlition S commits to actively engage with major research funders worldwide in order to foster alignment with the Plan S guidelines among collaborating authors' (cOAlition S, 2020: 4).

competitive positions outside the sphere of influence of cOAlition S. This then raises a major question: when faced with such risks, will Europe still be seen as an attractive place to conduct research for international researchers, and will our ongoing collaborations still continue?

The Impact of Plan S on Academic Freedom

Research can only be prosperous where and when researchers have as much freedom as possible to decide how their research is conducted and disseminated. By restraining cOAlition S-funded researchers to only publish their work in Plan S-compliant journals, this new mandate is adding an additional set of constraints on this freedom. As a further burden in the context of an already complex administrative environment surrounding research, one can be excused for feeling that academic freedom is being eroded under the cover of public access to specialized publications.

This issue is further complicated by the fact that there is no European or global definition of academic freedom (Anderson, 2015, 2018). Diverging local conventions and legal frameworks would seem to pose a considerable challenge for a Europe-wide initiative of this kind — especially one with expansionist ambitions — at least if the need to respect academic freedom is to be taken seriously. This would appear to have been a blind spot in the thinking of those who formulated Plan S. Before shaping the European market for scholarly publishing, it would be beneficial to define what the rights and duties of a researcher are taken to be. For example, academic freedom is recognized as a constitutional right in Germany, and thus researchers have full liberty to conduct their work and to publish the outcomes of it.[27] In France, where most researchers are paid by the state and thus should be loyal to it, it is recognized that researchers have freedom of speech and can freely criticize the government in their respective domain of competences, providing they follow scientific principles in doing so.[28] In Sweden, freedom of publication is protected by law.[29] In Norway, a recent report commissioned by Unit — the government directorate responsible, amongst other things, for negotiating consortium agreements with publishers on behalf of Norwegian universities — has concluded that the attempt to mandate the use of the most liberal open access licenses, which Plan S requires except under

27. The German constitution states: 'Art and science, research and teaching are free. Freedom of teaching does not absolve from loyalty to the constitution' (Art. 5, para. 3).
28. 'Code de l'Éducation: Article L952-2', Legifrance website : www.legifrance.gouv.fr/affichCodeArticle.do?cidTexte=LEGITEXT000006071191&idArticle=LEGIARTI000006525617&dateTexte=20190822 (accessed 19 October 2020).
29. Swedish Council for Higher Education, 'The Swedish Higher Education Act (1992:1434)': www.uhr.se/en/start/laws-and-regulations/Laws-and-regulations/The-Swedish-Higher-Education-Act/#Chapter%201 (accessed 19 October 2020).

exceptional circumstances,[30] is in breach of academic freedom as protected under Norwegian law (Kielland, 2019). Clearly, insofar as there are significant concerns about the implications of Plan S for academic freedom, these need to be taken seriously and dealt with satisfactorily before the Plan can be implemented.

We thus believe that general principles should be derived from national legislation and extended to offer global protection to European researchers. Three principles in the Swedish law surrounding this issue seem particularly important to us:

1. research issues may be freely selected
2. research methodologies may be freely developed
3. research results may be freely published.

We firmly believe that open access mandates should take these principles into account.

WIDESPREAD CONCERNS ABOUT PLAN S

As Plan S has caused significant disquiet in the research community, there have been countless open letters, petitions and opinion pieces expressing concern with regard to the risks posed by Plan S for scholarly communication. For example, in an open letter to Swedish decision makers dated 15 November 2018, the Young Academy of Sweden expressed its concerns for the impact on the careers of young researchers, stating that:

> Plan S does not address concerns about research quality, only publishing format and we worry that Plan S may itself introduce new problems in the system. Plan S threatens to introduce pay-to-publish mechanisms, which could severely jeopardize academic quality and thus create chaos in the current — relatively well functioning — structures for peer review. This will have far reaching effects at various levels, from individual publication to evaluation for grants and research funding, and to evaluation for promotion. Such an upheaval may not pose a significant problem for professors drawing close to retirement, but for us, with at least 20–30 more years to work, it is a significant concern. (Young Academy of Sweden, 2018)

Concerns were not limited to the Young Academy: an open letter initially signed by 111 Swedish professors, and with an expanding number of signatures, demands that Swedish research councils that are already part of cOAlition S withdraw their participation, and that work towards open access should take place in genuine collaboration with the research community.[31] Since this letter came out, Riksbankens Jubileumsfond have withdrawn from

30. 'For any chosen route to compliance [with Plan S], the publication must be openly available immediately with a Creative Commons Attribution license (CC BY) unless an exception has been agreed by the funder' (cOAlition S, 2020: 3).
31. 'Plan S Protest': plansprotest.se (accessed 19 October 2020).

membership of cOAlition S, although they state in their withdrawal press release that they still support the cOAlition's goals.[32]

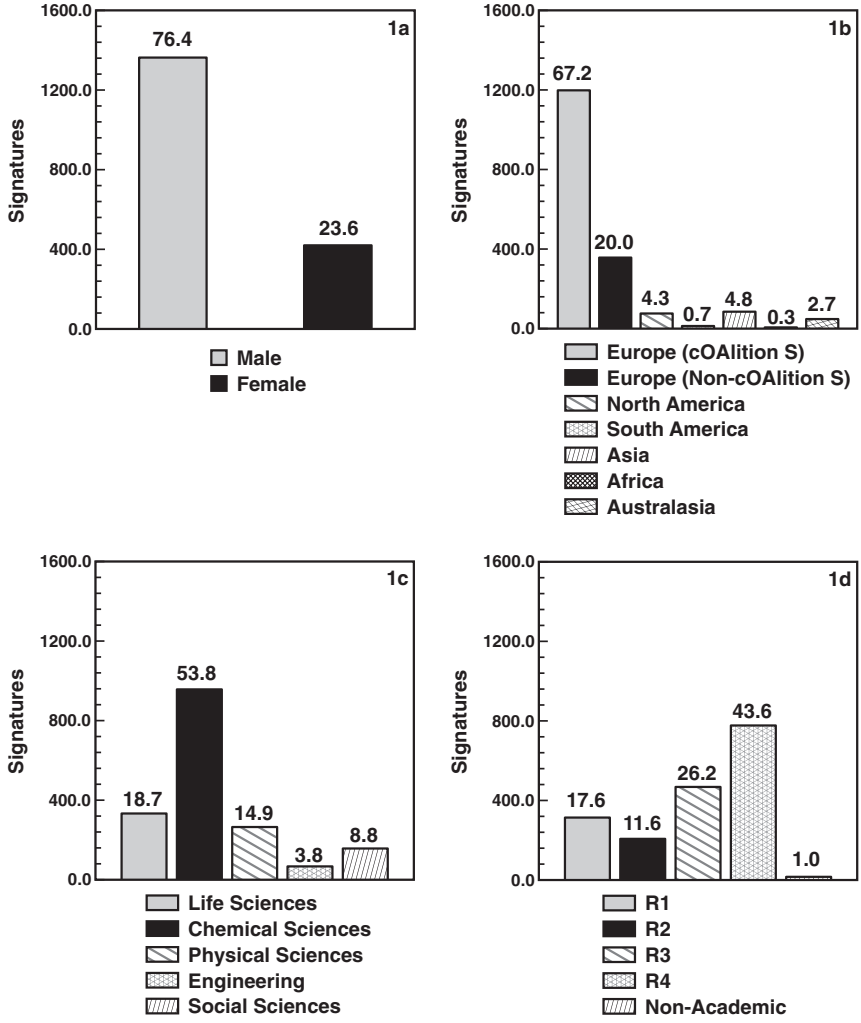
The debate about Plan S in Norway has been described as 'open war' (Eliasson, 2019) with, at the time of writing, over 1,100 persons having signed an open letter formulated by the Peace Research Institute Oslo demanding proper risk analysis of the consequences of Plan S (PRIO, n.d.). PRIO, a leading social science and humanities research institution, has been central in the Norwegian debate over the potential consequences of Plan S, but concerns are shared across a wide spectrum of disciplines, and the signatories to the open letter include leading researchers, Nobel laureates and heads of institutions from across the country.

As chemists, three of the authors of this contribution expressed our concern first in a blog piece (Kamerlin et al., 2018), and subsequently in an Open Letter, which we opened up to the broader research community to sign, initially as a Google Doc that was distributed among our colleagues by word of mouth, and now as its own website (de Bruin and Kamerlin, 2018a). In this letter, we outlined our main concerns about Plan S, as described above, in particular from a chemistry perspective, and with a focus on the impact of Plan S on researchers in the chemical sciences. This open letter very quickly gathered several hundred signatures (1,783 as of 29 June 2019), as well as becoming the subject of substantial media coverage (see de Bruin and Kamerlin, 2018b, for just a few examples).

Considering the Euro-centric and subject-specific focus of our Open Letter, what greatly surprised us was the breadth of signatures this letter received. An overview of some signatory statistics is shown in Figure 1, which illustrates the distribution of signatures by gender, country, discipline and career stage. The geographic distribution indicates the country the signatory was based in at the time of signing the letter, not their nationality, and the distribution by career stage was performed using the standard EU definition, in which R1 denotes a first stage researcher (up to the point of PhD), R2 denotes a recognized researcher (PhD holders or equivalent who are not yet fully independent), R3 denotes an established researcher (researchers who have developed a level of independence), and R4 denotes a leading researcher (researchers who are leading their research area or field).[33] Note that due to differences in career systems in different signatory countries, the translation onto the R1–R4 career stages was not always straightforward. The same challenge held true for division by discipline, as many researchers work at the interface between different disciplines. From the list of signatures, it can be seen that there is a strong bias towards signatories from European countries where major funding agencies are members of

32. Riksbanksens Jubileumsfond, 'RJ Ställder Sig Vid Sidan av Plan S': www.rj.se/debattinlagg/2019/rj-staller-sig-vid-sidan-av-plan-s (accessed 19 October 2020).
33. See MORE3, 'Career Stages R1 to R4': www.more3.eu/indicator-tool/career-stages-r1-to-r4 (accessed 19 October 2020).

Figure 1. Signatories to our Plan S Open Letter: Distribution by Gender, Geographic Origin, Discipline and Academic Career Stage.



Notes: Based on 1,783 signatures, 29 June 2019, shown as both total signatures and % from each category. Figure 1d: R1 = first-stage researcher (up to the point of PhD); R2 = recognized researcher (PhD holders or equivalent); R3 = established researcher; R4 = leading researcher *Source*: de Bruin and Kamerlin (2018c)

cOAlition S (67 per cent of signatories), with a further 20 per cent of signatures coming from non-cOAlition S European countries. The remaining 229 signatures (13 per cent) come from North and South America, Asia, Africa and Australasia. This includes signatories from 12 countries where major funding agencies have joined cOAlition S, and signatories from 40 other countries across the world. The disciplinary distribution of the

signatures was the biggest surprise to us: while the letter primarily targets researchers in the chemical sciences, only 54 per cent of signatures are from researchers in this field, with 19 per cent coming from researchers in the life sciences and medicine, 15 per cent from the physical sciences, 9 per cent from the social sciences and humanities, and 4 per cent from engineering. This indicates that while initially we believed our concerns to be chemistry specific, they in fact resonate with researchers from across a wide range of disciplines. Similarly, while the largest single block of signatures came from leading researchers (R4, including Nobel laureates, winners of other prestigious distinctions such as the Spinoza Prize, institute directors, heads of departments, members of National Academies, and researchers with other senior leadership roles), 26 per cent came from established (but not yet leading) researchers (R3), 30 per cent from early career researchers (R1+R2), with a final 1 per cent from non-academic researchers either in industry or private citizens.

Therefore, based on the signatures on our open letter, we can conclude that researchers at all career stages, from a wide range of disciplines, and from across the world, are concerned about the implications of Plan S on scholarly communication and how collaborative research will be conducted in future. Once we had obtained a critical mass of signatures, we sent our Open Letter to the leadership of all funding agencies that are members of cOAlition S, as well as outlining our concerns in a contribution to the recent consultation performed by cOAlition S (de Bruin and Kamerlin, 2019). Finally, we note that several other scientific societies and academies, including chemical societies such as the ACS and EuChemS, have voiced concerns that largely overlap with ours, as can be seen from the various inputs provided to cOAlition S as part of the feedback to the implementation guidelines (cOAlition S, 2019b).

IMPLICATIONS OF THE REVISIONS TO THE PLAN S GUIDELINES

On 31 May 2019, cOAlition S released revised implementation guidance on Plan S (cOAlition S, 2019a), as well as offering a rationale for the revisions (cOAlition S, 2019c). We have provided detailed responses to these revisions elsewhere (de Bruin et al., 2019). In brief, there are a number of changes in the revised implementation guidelines that we consider positive, such as the fact that CC-BY is no longer mandated as the only option with waivers for other open licenses (although we note that the non-commercial clause is still not permitted), with a delay to the start date and a — possibly temporary — relaxation of the technical requirements on repositories.

However, the green route as presented by cOAlition S is still problematic, as publication in reputable subscription journals will require deposition of the final author accepted manuscript (AAM) / version of record (VoR) in a compliant repository with no embargo period under a CC-BY license, which

the majority of reputable journals, whether in natural or social sciences, do not accept. This means that the green route is only accessible to either well-funded researchers with a diverse funding portfolio, who have other funds to cover publication costs, or to researchers at very well-funded institutions who have either individually or through library consortia entered into agreements with specific publishers to fully or partially cover publication fees. Therefore, the green route is still an illusion of choice, that disenfranchises most researchers who don't have the funds to make the article compliant with cOAlition S requirements. Whether the recently introduced Rights Retention Strategy of Plan S will make this route more viable remains to be seen, but it is doubtul if journals are willing or able to move in that direction.

In addition, the large number of concerns raised by researchers and researchers' organizations, discussed in the previous section, have been effectively ignored, including concerns about the push towards APC-based publishing, the effects of Plan S on the quality of peer review and international collaboration, and the negative impact on early career researchers. Furthermore, there is still a tremendous focus on sanctions, which we believe is likely to alienate the research community. In its open letter, the Young Academy of Sweden stated:

> It is thus our conclusion that the radical Plan S will not be helpful in supporting young scientists, nor will it improve European competitiveness in science and innovation as desired by the ministers in the EU Competitiveness Council. On the contrary, the proposal [...] threatens to shatter researchers' trust in politicians and destroy long-term collaborative goals for open science. (Young Academy of Sweden, 2018)

Unfortunately, we believe that the cosmetic revisions made to Plan S do little to alleviate these concerns.

ADDITIONAL THOUGHTS AND CONCLUDING REMARKS

In this academic thought piece, we have provided a brief overview of the history of and current trends in relevant publishing practices, as well as how we believe ever more aggressive open access mandates such as Plan S are likely to affect these publishing practices in the future. We have written this piece from our own perspective as active academic researchers in the field. Some key final points we would like to highlight are listed below.

Plan S focuses on a very narrow aspect of open science, which entails a much broader agenda than free access to the final research product. Open science also entails factors like the co-creation of research, sharing of data and code, and communicating research findings to non-experts. It is a style of doing research. This is particularly important in a global context, because even if the articles are open access, if other researchers don't have access to the code and data, this restricts the usefulness of the article itself. We find it

curious in this context that Plan S has little or no focus on other aspects of open science, including data management practices.

Tying in with this, a central tenet of Plan S and other similar OA mandates is that the outcomes of taxpayer-funded research should be freely available to the taxpayer. While we fully share the ambition to make publicly funded research available in the public domain, we are, however, not convinced that making the final, typeset scientific articles freely available is necessarily the most efficient way to convey most scientific results to non-experts. In many cases, the articles are so specialized that they de facto exclude non-specialists. Thus, rather than making final publications available, what is needed is more effective and professionalized research communication, 'translating' research for the general public.

Finally, it is important to emphasize that scientific journals function not merely as research communication channels, but also as scientific communities where researchers meet and exchange ideas with peers; the responsibility for carrying the burden of reviewing and editing is shared across a large number of individuals contributing to what is seen as a vital scientific infrastructure. These communities, especially those that develop around professional societies, whether in chemistry, in social sciences and humanities research, or in other scientific domains, sustain long traditions for quality control, sound research practices and scientific development and innovation. These are structures that we to some extent take for granted today, but that, if mismanaged through a rapid and poorly designed transition to open science as in the Plan S implementation process, are seriously at risk.

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Shina Caroline Lynn Kamerlin (corresponding author: lynn.kamerlin@kemi.uu.se) is Professor of Structural Biology studying protein evolution at the Department of Chemistry, BMC, Uppsala University, Sweden. She also focuses on science policy (Open Science and researcher careers), as well as diversity, equality and inclusion. She serves on several Editorial and Editorial Advisory Boards. ORCID ID: orcid.org/0000-0002-3190-1173.

David J. Allen (davall@prio.org) is a senior adviser at the Peace Research Institute Oslo (PRIO), Norway. He holds a PhD in philosophy and has a background in scholarly communication, having previously worked with journal publishing and Open Access monographs at the Oslo-based academic publisher, Scandinavian University Press. ORCID ID: orcid.org/0000-0002-2167-1490.

Bas de Bruin (b.debruin@uva.nl) is Professor of Bio-Inspired Catalysis, Van 't Hoff Institute for Molecular Sciences, University of Amsterdam, The Netherlands. His work focuses on cooperativity, metallo-radical catalysis and development of new catalytic reactions for organic synthesis. He serves

and has served on several Editorial and Editorial Advisory Boards. ORCID ID: orcid.org/0000-0002-3482-7669

Etienne Derat (etienne.derat@sorbonne-universite.fr) is Associate Professor in computational chemistry at Sorbonne Université, CNRS, Institut Parisien de Chimie Moléculaire, IPCM, Paris, France. Etienne's main interest is in understanding chemical reactions involving metals and radicals, sometimes coupled to enzymatic systems. He is responsible for information literacy teaching for graduate students. ORCID ID: orcid.org/0000-0002-8637-2707

Henrik Urdal (urdal@prio.org) is Director and Research Professor at the Peace Research Institute Oslo (PRIO), Norway. He is past Editor-in-Chief of the *Journal of Peace Research*. His recent articles on political demography have appeared in *Conflict Management and Peace Science*, *Demography*, *Review of Education Research* and *World Development*.