Is it worth 'flipping' your favourite journal to open access? An opinion

Geoffrey Bodenhausen

Professeur émérite, Ecole Normale Supérieure-PSL Research University, Département de Chimie, 24 rue Lhomond, 75005 Paris, France; Professeur honoraire, EPFL; Professeur honoraire, UNIL; Executive editor of the open access journal 'Magnetic Resonance'.

Email. Geoffrey.Bodenhausen@ens.fr

DIALOGUE
Science, Scientists, and Society

Table of Contents

Is it worth ‘flipping’ your favourite journal to open access? An opinion

Geoffrey Bodenhausen

Professeur émérite, Ecole Normale Supérieure-PSL Research University, Département de Chimie, 24 rue Lhomond, 75005 Paris, France; Professeur honoraire, EPFL; Professeur honoraire, UNIL; Executive editor of the open access journal ‘Magnetic Resonance’.

Email. Geoffrey.Bodenhausen@ens.fr

ORCID: 0000-0001-8633-6098

Abstract. In the course of 2019, a new open access journal called *Magnetic Resonance* was launched by the *Groupement Ampère* in Zurich. The journal is produced by a small publisher in Göttingen, Germany, that has gathered experience with a palette of journals run by the *European Geosciences Union* (EGU). The initial idea of *Magnetic Resonance* was to create a so-called “gold” open access journal: one can freely download all papers, including preliminary and revised versions, reviewers’ critiques and authors’ replies, while the authors’ institutions pay reasonable Article Processing Charges (APCs). The new journal is independent of learned societies like the *Royal Society of Chemistry* (RSC) and the *American Chemical Society* (ACS), and it is not exposed to profit-oriented business models of commercial publishers like RLX/Elsevier, Springer/Nature, Cell Press, and Wiley. After about 2 years, it seems appropriate to publish a few remarks about our experience of the strengths and weaknesses of open access publishing. Our discussion draws on a detailed analysis of the Ethics Committee of the French CNRS, and on a debate organized by the Royal Dutch Academy of Science.

Keywords: Open access; Author page charges; Gold and diamond; Waivers; Public peer review.

Introduction

When it was decided to launch *Magnetic Resonance* in the course of 2019, our motivation was quite straightforward. Publishing should remain protected from commercial interests, should not be exploited to make undue profits, and remain as ethical as possible. Many commercial companies (RLX/Elsevier, Springer/Nature, Cell Press, and Wiley) derive huge profits from public research. Their example has been followed by prestigious institutions such as the

American Chemical Society (ACS), the American Association for the Advancement of Science (AAAS), and the Royal Society of Chemistry (RSC), to cite only a few, who realized that they too could make a hefty fortune with little effort. Negotiations between public libraries and publishers are often coordinated on a national level, for example by the French Couperin consortium or the German DEAL. When the negotiators agree on a compromise, the terms are invariably hidden from the public through "non-disclosure agreements". The secrecy of these negotiations confirms our worst suspicions. Indeed, the takeover of the noble enterprise of scientific endeavor by multinational profit seekers is best hidden from the public eye. To satisfy their greed, publishers and learned societies alike fuel the lethal fashion of bibliometrics and impact factors, *with the paradoxical support of both researchers and administrators*, the former because bibliometrics comfort their vanity, the latter because bibliometrics simplify evaluations (Balaram 2021). We scientists know all too well that the number of citations gathered by a much-cited paper is a totally inadequate measure of the quality of other papers published in the same journal. Can one compare some software package with a profound idea like 'phase encoding' in magnetic resonance imaging (MRI) by Anil Kumar, Dieter Welti, and Richard Ernst (Anil Kumar et al. 1975)? Shouldn't we scientists cringe at the idea of measuring the quality of our work in terms of a single number? Surely, the value of a cultural creation - be it in music, plastic art, or research - cannot be measured in a single dimension. Does anybody wish to rank Leonardo da Vinci, Francesco de Goya, or Paul Cézanne in terms of auctions? Shouldn't we scientists balk at seeing our work degraded to a mere merchandise? Richard Ernst, who recently passed away (Bodenhausen 2021), once expressed his personal wish "*to send all bibliometrics and its diligent servants to the darkest omnivorous black hole that is known in entire Universe, in order to liberate academia forever from this pestilence*" (Ernst 2009).

Ethics

The Ethics Committee (COMETS) of the French CNRS has published a remarkable in-depth 'opinion' (see Appendix) that contains a wealth of useful information, such as definitions of Gold, Diamond and Hybrid models, Transformative Agreements, Plan S, DORA, Article Processing Charges (APCs), archives like BioRxiv and HAL, pirate websites such as 'Sci-Hub', undue profits collected by publishers, predatory journals, negotiating agreements with publishers, etc. The 'opinion' of the CNRS not only describes different modalities but also examines some of their perverse consequences. "The excessive profits of the major publishers encourage researchers to circumvent intellectual property rights with a clear conscience, while these same publishers, even if they file a complaint, can ultimately only turn a blind eye to these breaches of the law which, after all, disseminate their output." Another perverse effect of undue profits is the multiplication of journals without any guarantee of scientific rigor. Such journals artificially boost the number of papers, some of which may be downright fraudulent. Very few of these papers will ever be read by anyone. More and more open access journals have sprung up. They must be distinguished by their way of recovering the unavoidable costs

of publication. Most open access journals require the payment of page charges, either by the authors or by their employers. The CNRS 'opinion' analyzes in detail the different modalities (Diamond, Gold, Green and Hybrid models). The 'opinion' shows how researchers can deposit preprints of their articles on open access preprint servers even before their evaluation, thus communicating them without delay to the entire community, which offers an opportunity to discuss and improve them. The 'opinion' explains why scientists should abide by DORA principles and adopt Creative Commons licenses. It recommends strengthening the interoperability of international open archives. The 'opinion' provides harrowing figures on the profits of the publishers that must be denounced. One comes to realize that the crisis of scientific publishing has reached amazing proportions. Thus, in 2017, more than 1000 publishers, many of whom may be regarded as 'predatory', have emerged and marketed approximately 10,000 journals! The full text of the 'opinion' of the CNRS is attached as Appendix to this paper. It analyzes the consequences of open access on the evaluation of researchers, and offers an up-to-date, virtually encyclopedic source of valuable information, complete with an exhaustive glossary.

Since 2018, many funding agencies, particularly in Europe, have applied pressure towards Open Access with an ambitious scheme called Plan S. Many of us have a hard time appreciating the *pros* and *cons* of Plan S. In a nutshell: for a journal to be compliant with Plan S, there should be no pay-walls, no embargo periods, and no hybrid deals. But Plan S does not deny that there are some costs inherent to publishing, formatting, archiving, and referencing in data bases like Web of Science. Page charges should not be paid by authors, but by funders or governments. All papers (including of course those submitted to *Science, Lancet, Cell* or *Nature*) must be made instantly available in public repositories. Copyright must remain in the hands of the authors. Transformative Model Agreements, despite their popularity in Germany, are regarded with suspicion by the advocates of Plan S. Non-compliance can be sanctioned: in the Netherlands, the Dutch Research Council (NWO) plans to withhold 2.5% of grants if the authors do not comply.

Plan S may turn out to be divisive

In accordance with its policy, the views of the Ethics Committee of the CNRS are as fair and balanced as they could be. We found it stimulating to compare these politically unassailable views with some more controversial commentaries. In this spirit, we recommend a Webinar on Open Access organized by the Royal Dutch Academy of Science (KNAW) on June 23rd 2020 (van Saarloos W 2020). Some Dutch scientists believe that the Netherlands are close to realizing full Open Access and optimistically expect this fashion soon to sweep across the entire globe. Others fear that Plan S may turn out to be divisive, since it is supported neither by Germany (where the authorities tend to favor the transformative route), nor by China, nor by the USA, where granting agencies appear reluctant to provide funding for Gold or Hybrid OA. In the USA, scientists tend to prefer repositories such as PubMed, arXiv, ChemRxiv, and BioRxiv, that massively archive preprints of papers of biomedical, physical and chemical interest. But many

preprints on these repositories have never been reviewed. The authors, once their papers get reviewed, revised and published in respectable journals, often neglect to upload the final versions, knowing that most publishers prohibit the open dissemination of papers that are properly formatted with volume and page numbers. Understandably, since adding volume and page numbers is the only significant contribution by publishers to the production of these papers! The KNAW Webinar on Open Access mentions that the effects of Plan S are unpredictable for less favoured countries and charitable foundations, as are the risks of increasing prices, and the possible loss of freedom to choose journals based on the reputation of their editorial boards. Hefty APCs such as those practiced by *Scientific Reports* (Nature) or *Science Advances* (AAAS) worsen inequalities between institutions and authors. Indeed, 'gold open access' is not necessarily an attractive route for human and social sciences. Nor is gold open access favorable for retired faculty, whose former employers may be reluctant to support APCs.

Open Access is not an easy road

Against this complex background, we started a specialized journal called *Magnetic Resonance* in 2019 (https://www.magnetic-resonance-ampere.net). The *Groupement Ampère* signed a contract with a small not-for-profit publishing company that specializes on producing high quality open access journals. We put together a strong editorial board. Yet success was slow to come. When trying to understand the reluctance of some authors to submit papers to our new journal, we noticed that some colleagues do not wish to harm learned societies like the American Chemical Society (ACS) and the Royal Society of Chemistry (RSC). I fail to understand their loyalty. Personally, in the course of 40 years, I have paid a fortune in membership fees to the Swiss, American and French chemical societies, but I do not remember ever getting any significant benefits in exchange, except for some symbolic reductions of conference fees. I would make an exception for the *Groupement Ampère*, the owner of *Magnetic Resonance*, which also acts as a sort of insurance company for EUROMAR and other meetings.

Self-serving claims of traditional publishers

While *Magnetic Resonance* is gradually becoming recognized as a respectable journal where about two new manuscripts are submitted every week, some of the profit-seeking companies and societies mentioned above desperately attempt to defend their market share. Thus, the historical *Journal of Magnetic Resonance* is now backed up by the new *Journal of Magnetic Resonance Open*. Other highly profitable publishers may be forced to make further concessions. It is noteworthy that Elsevier remains unyielding in many key negotiations, e.g., with the German DEAL. If Elsevier, Cell and Lancet would ever become compliant with Plan S, it would be interesting to see if their profits shrink from a stratospheric 35-40% to a more reasonable 5-

10%. Some may simply abandon ship – if major airlines, plane and car manufacturers are facing bankruptcy in the wake of the current pandemic, why should taxpayers rescue predatory publishers? In our view, the services they offer are far inferior to the support provided by the not-for-profit publisher of *Magnetic Resonance*. The latter offers competent language editing, a service that most major publishers have long abandoned to reduce their costs. No commercial publisher can have any valid excuses for charging more than *Magnetic Resonance*'s modest fee of 75-80 €/page, which is only a fraction of the subscription and open access fees charged by traditional publishers, although it may still be too much for authors in less favored countries. Setting up *Magnetic Resonance* has provided clear-cut evidence that it is *not expensive* to produce a high-quality journal, provided its owner and its editors do not derive any excessive benefits. This stands in blatant contradiction to the self-serving claims of traditional publishers and their overpaid editors.

A recent paper published in Science (Brainard 2021) reveals both the arrogance and insecurity of those who depend on a profit-oriented business model. Apparently unaware of committing a brazen conflict of interest, Sudip Parikh, CEO of the AAAS that produces *Science*, is quoted *in one of his own journals* for saying 'I am worried that in the zeal to go that last mile' [to make a larger portion of articles open access], 'we could end up *really hurting the scientific enterprise*.' Does Sudip Parikh really confuse the value of 'scientific enterprise' with the market value of his magazine, boosted by a scandalous pricing policy? Could it be that he is blinded by fears for his own privileged position? Prices are indeed staggering: while Science Advances (a daughter of Science) charges a gold open access fee of a mere 4500 $, the Nature Research family of journals has set its top hybrid open access fee at 9500 € (about 11600 $), while Cell Press charges a hybrid fee of 9900 $ for a paper in *Cell* and 8900 $ for a paper in *Chem*.

[1] See, for example: https://openaccess.univ-rennes1.fr/les-revues-predatrices Preregistration entails submitting research conditions to a peer review before beginning work.

Table 1 "Hybrid" open access charges paid through the author's ERC grant in 2014 to comply with ERC rules.

Dalton Transac.	2112 €	Chem. Phys. Lett.	2279 €
Chem. Phys. Lett.	3156 €	J. Phys. Chem. Lett.	5100 €
J. Phys. Chem. B	5100 €	Magn. Reson. Chem.	3348 €
Chem. Eur. J.	3000 €	Chem. Eur. J.	3000 €
PNAS	2550 €	Angew.Chem. (again)	3500 €
Angew. Chem.	3500 €	ChemPhysChem	2500 €
ChemMedChem	2500 €	Phys. Chem. Chem. Phys.	2112 €
J. Magn. Reson.	3420 €		

This adds up to 47177 € for 2014 alone. Of the 15 hybrid open access papers that we published in 2014, the total number of pages was only 90, so that we paid 524 € per page, or 3145 € per paper. By comparison, at the rate of 80 € per page, *Magnetic Resonance* would have charged a mere 7200 € rather than 47177 €, i.e., a reduction of 85%. Of course, this advantage comes at the expense of attractive impact factors (new journals have to wait about 3 years before their impact can be assessed.) Needless to say, the hybrid open access fees charged by profit-oriented publishers come on top of the stratospheric subscription fees that they impose through opaque agreements onto helpless consortiums of libraries. One may wonder what the publishers do with their profits, other than buying up competitors to consolidate their empires.

After wasting so much money in 2014 merely to comply with the ERC rules, I decided to stop dilapidating precious resources on greedy publishers. I expected to get a stern warning from the ERC for non-compliance with their rules, but mercifully this has not happened so far, 2 years after filing my final report. Oversight or deliberate leniency?

The situation has become even worse since 2014. After a few of Richard Ernst's former co-workers submitted an obituary to *Angewandte Chemie,* Wiley informed the authors that they would have to pay 4000 € if they did not want their text to remain hidden behind a paywall. For a more recent paper on the 'legacy' of Richard Ernst, written for *Chem* (Cell Press), Elsevier wanted a hybrid fee of 8900 $. A trifle!

Publicly accessible reviews, an added bonus of flipping to open access

Although our primary concern was to "flip" to open access, *Magnetic Resonance* also benefits from a remarkable public review system that was developed for a range of journals managed by the *European Geosciences Union* (EGU). Reviewers can reveal their identity if they wish. Experience shows that they sometimes recoil from this opportunity if they recommend rejection. All reviews, whether anonymous or not, are published on the website of the journal, along with all rebuttal letters and improved manuscripts provided by the authors. This allows readers to follow the ordeals and tribulations of individual papers on their way to final publication or rejection. We believe that this improves the quality of submitted papers, since few authors are willing to risk public ridicule. Reading reviews may at times be more informative, or at least more entertaining, than reading the papers themselves! Public reviews could also be promoted by societies like the RSC and ACS, or indeed by commercial

publishers, but they seem reluctant to improve their highly profitable business model that was developed in the days of traditional ‘paper’ journals.

To our disappointment, most papers received by *Magnetic Resonance* stem from European laboratories. Authors from other countries seem to ignore our initiative, despite our efforts to appoint prominent board members from all over the globe. Most papers come from physics, few from chemistry, and hardly any from biology. Impact factors appear to have more perverse effects in biology than in physics and chemistry.

Conclusions and prospects

Clearly, page charges, however reasonable they may be, constitute an impediment to the dissemination of science, particularly for less favored countries. Fortunately, there is a path to move gradually from ‘gold’ to ‘diamond’ open access. In the former model, the authors or their employers pay the page charges. In the latter, these charges are paid by public institutions such as universities, granting agencies, ministries of research, etc. The transition from ‘gold’ to ‘diamond’ open access could be made smoothly if the public institutions were willing to increase their support for gold open access journals, while reducing their payments for exorbitant subscription and hybrid fees. Initially, waivers of APCs would be granted only to authors from less privileged countries and institutions (as is currently done by *Magnetic Resonance*). The criteria for granting such waivers could gradually be opened up. We have applied in vain to the French ministry of research for funding in this spirit. India seems to be far ahead of France in these matters. The Science Academies of India (Chakraborty et al. 2020) have suggested that journals published by academic societies, academies, etc., should be supported by public money/governmental support so that these journals can provide full open access to readers without the need for anyone (authors, readers or funders) to pay for the cost of publication. Ultimately, all APCs should be fully waived across the entire world, and the costs of scientific publishing should be entirely borne by public institutions, so that predatory publishers could be dispensed with altogether.

This paper attempts to show to colleagues across all disciplines that it is relatively easy to “flip” to an open access format by setting up a new journal. In the end, we have come to realize that the dispute about *pros* and*cons* of open access reflects the old divide between regulated and unbridled forms of capitalism: some believe that the economy must be kept under control by rules and regulations, while others believe that it should be left to develop its dynamics freely towards unlimited profiteering. Until the emergence of monopolies leads to such a deep crisis that a reappraisal cannot be avoided. Needless to say on which side we stand.

Conflict of interest

The author is one of the executive editors of the open access journal *Magnetic Resonance*, which has provided him with some valuable experience. However, this paper aims at a broader audience and is by no means intended to convince authors to submit papers to our highly specialized journal.

References

Anil Kumar, Welti D and Ernst R R 1975. NMR Fourier zeugmatography J. Magn. Reson. 18 69-83.

Balaram P 2021. https://www.youtube.com/watch?v=ndtYh_rp7yw

Bodenhausen G 2021. Richard Ernst (1933–2021) Chemist who made magnetic resonance powerful tool Science 373 164.

Brainard J 2021. Open Access Takes Flight Science 371 16-20.

Chakraborty S, Gowrishankar J, Joshi A, Kannan P, Kohli R K, Lakhotia S C, Misra G, Nautiyal C M, Ramasubramanian K, Sathyamurthy N and Singhvi A K 2020 Suggestions for a national framework for publication of and access to literature in science and technology in India Current Science 118 1026-1034. DOI: 10.18520/cs/v118/i7/1026-1034

Ernst R R 2009. The Follies of Citation Indices and Academic Ranking Lists – A brief Commentary to 'Bibliometrics as Weapons of Mass Citation' Chimia, 64, 90

van Saarloos W 2020. https://www.youtube.com/watch?v=OCfRV-8MYto. The event was chaired by Wim van Saarloos, with contributions by Johan Rooryck and Stan Gielen, and minority opinions by Joost Reek, Frits Rosendaal, Claartje Mulder, and Birgit Meyer.

APPENDIX

Opinion no. 2019-40 of the Ethics Committee (COMETS) of the French CNRS

PUBLICATIONS IN THE OPEN SCIENCE ERA

Initially approved at the COMETS plenary session of 8 November 2019, then definitively approved on 14 January 2020

Definitive approval Opinion no. 2019-40 of the Ethics Committee (COMETS) of the French CNRS

WORKING GROUP MEMBERS:

Gilles Adda

Philippe Askenazy

Jean-Gabriel Ganascia

Michèle Leduc

Lucienne Letellier

Antoinette Molinié

Nathalie Nevejans

RAPPORTEURS:

Michèle Leduc

Antoinette Molinié

SUMMARY

The opening up of scientific publications heralds new, very stimulating opportunities as they offer universal access to all human knowledge to anyone, anywhere, any time. This Opinion describes the different methods and procedures involved and examines the consequences, that may be unintended. While more and more open access journals use peer reviews in the selection process, they may be differentiated by the way in which the costs of publication are financed. Most of the time, these costs give rise to the payment of article processing charges (APCs) either by the researcher-authors themselves, or by their host organisation. If we are not careful, the result is an unjust system that not only creates inequalities between researchers but also generates unfair profits for publishers through public investment and the work of scientists who both provide research and assess other researchers' work free of charge. There is furthermore a multiplication of editorial offers with reduced APCs but without any guarantee of scientific rigour, a situation that artificially multiplies the number of publications and arouses suspicion. It is difficult to identify these journals, some of which may be considered unreliable if not to say fraudulent. In addition, open archives such as the HAL online archive, allow research documents to be deposited free of charge on a web platform, making them immediately accessible to all. This "green route" has the approval of COMETS, which invites researchers to use it to submit their papers once they have been accepted. Authors can also deposit their articles online as preprints even before they are reviewed, thus instantaneously communicating them to the whole community. Other members can then discuss the articles, leading to improvements. Veritable scientific forums can then spontaneously emerge. Although online preprints are not peer reviewed prior to dissemination, a review can nonetheless be organised through the 'Peer Community in' (PCI) system. Numerous models are emerging that do not demand APCs. Epi journals—considered as "overlay journals" built above open archives—for example, offer open-access publication that relies on researchers themselves and expert reviews, avoiding the intervention of private publishers. The OpenEdition web platform offers a complete electronic publication infrastructure for the humanities and social sciences (HSS) without any APCs and with free access to publications in html format. This COMETS Opinion identifies several novel ways of benefiting from open access publication. In its introduction, it describes the difficulties related to peer reviews and seeks alternatives. Finally, it analyses the consequences of open publications on the assessment of researchers and makes recommendations to improve reviews while preserving "bibliodiversity". COMETS recommends in particular supporting initiatives taken by researchers to promote open publications, consolidating the interoperability of open archives—in particular HAL—with other international open archives, applying the DORA principles and adopting Creative Commons licences.

FORMAL INTERNAL REQUEST

The international context is conducive to the opening up of science to the whole research community and more broadly to the general public and the media. Through "Plan S" (see below and Annex 2), French institutions are following the lead of the European Research Area by imposing the immediate, free and universal availability of publications and, whenever possible, of data resulting from research carried out with public funds.

While reaffirming its commitment to open access to scientific publications, COMETS believes that it is necessary to keep a critical and watchful eye on the wide range of innovations that are emerging, especially in view of the accelerating pace of change in scientific publishing resulting from this new openness.

More generally, COMETS believes that it should question the policy of disseminating public research work and address the issue of returning to taxpayers the fruit of the research they have funded. After several long battles with public institutions, the major private publishers have taken over the job of publishing scientific results. They have turned the vast pool of research results into a particularly profitable commodity since research is most often provided free of charge by researchers, who furthermore assess other researchers' work free of charge.

Whether funders or operators, public research institutions need to develop a new policy on the dissemination of scientific output within the framework of open science. Its financing poses major economic issues, as some publishing costs are unavoidable and cannot be borne by researchers. Innovative models of scientific publication are now emerging. COMETS will herein consider both the progress and the ethical risks related to these various solutions.

These upheavals also raise questions about the role of publications in the assessment of researchers and the peer review system used to validate these publications.

After months of work, this Opinion was discussed at length during the COMETS plenary session of 8 November 2019. It was finally decided to approve it, subject to a few amendments and additions. Ten days later, the CNRS Presidency published a "CNRS Roadmap for Open Science" setting out the institution's main guidelines with regard to the sharing of research results. We consequently added this note to specify the Opinion's scope.

While this roadmap is a general CNRS plan of action in favour of opening up science, the present COMETS Opinion proposes a detailed analysis of the questions raised by the opening up of scientific journals, which is only one aspect of the sharing of research results. It does not address either the opening up of the publication of books or open data. Its purpose is to inform researchers

and justify recommendations on the future of scientific journals. COMETS is pleased to note that its recommendations are in line with the main features of the CNRS strategy.

ANALYSIS

Open science, an invaluable driving force for research developments

The open dissemination of the results of scientific work is currently giving rise to a great deal of thought in France and abroad. It concerns researchers, their host institutions and publishers on the one hand, and on the other, civil society that is in many ways dependent on scientific progress.

The development of digital technology has significantly changed research practices themselves and not just the dissemination of research output. The launch of the Budapest Open Access Initiative in 2002[2] marked the beginning of concerns about the opening up of publications at a European level. The first European Union recommendations were made in 2012. In France, the Digital Republic Act of 2016[3]lays down rules on the free circulation of data and knowledge. The CNRS's Scientific and Technical Information Department (DIST) published an important White Paper on open science in 2016[4]. The ambitious National Plan for Open Science[5], initiated in July 2018 by the French Ministry for Higher Education, Research and Innovation (MESRI), is another milestone. The opening sentences clearly state that the objective of this National Plan is to make "*[public] research publications and data freely available...Open science seeks to create an ecosystem in which scientific research is more cumulative, better supported by data and more transparent with faster and more universal access to results [...]. It is an advance for both science and society".*

Opening up science to society

The fundamental impact of opening up science to citizens and the media comes in addition to the expected consequences for the way research in the academic world functions. Indeed, the objectives of open science concern not only the research community but society as a whole.

[3] French Digital Republic Act no. 2016-1321.
[4] White Paper: Open Science in a Digital Republic, published by the CNRS's Scientific and Technical Information Department (DIST) in March 2016. Synopsis of numerous DIST working documents made available online in 2015.
[5] The French Open Science Plan drafted by the Ministry for Higher Education, Research and Innovation
[2] www.budapestopenaccessinitiative.org

Sharing with our fellow citizens not only the results but also the working methods and practices of researchers, encourages trust in the progress engendered by science—which is increasingly being brought into question—and guides informed policy choices. Openness through the development of participative science is another way of fostering the scientific approach in the public mind. Participative science is thus an aspect of open science but will not be discussed herein as this report focuses specifically on publications. The virtues of participative science have already been highlighted by COMETS in a previous Opinion[6].

As stated in the introduction to the National Plan, "*open science fosters scientific integrity and people's trust in science*". More generally, giving back to the public the research it helped to fund can be seen as a civic obligation. It may, however, require mediation by teachers, scientific popularisers or specialised journalists so that the technicality of the texts does not lead to misunderstandings.

The term "open science" refers not only to open access to publications and participative science, but also to research data (raw or processed), calculation codes and algorithms. Access to data raises complex issues. In this Opinion, COMETS has chosen to address only the issues raised by the opening up of publications, understood in the broadest sense of disclosure of research results. The sharing of data, programs and algorithms is also part of open science, but the issues this raises are beyond the scope of this work. Moreover, we shall limit ourselves here to publication in the form of articles in scientific journals, leaving for another analysis the issues related to the publishing of scientific books, videos and films.

Consolidating ethics and scientific integrity

The opening up of scientific publications gives rise to very stimulating new perspectives because they offer universal access to human knowledge. Due to the contemporary architecture of the World Wide Web, information can quickly reach any part of the globe unhindered. This includes in particular the many countries—including France—where not all university libraries can afford to pay for subscriptions to scientific journals. To compensate for the inaccessibility of some journals, many researchers resort to pirate websites such as "Sci-hub", which illegally make articles available to the public free of charge, irrespective of regulations[7]. By allowing a better and faster circulation of knowledge, the opening up of publications (like the opening up of data) can only strengthen exchanges between teams. It should also be a way of strengthening scientific integrity[8], which has become an important policy concern for research organisations and universities. The dating and recording of results for the attribution of a discovery will be less controversial. Immediate access to a publication allows everyone to evaluate in real time the reasoning and quality of the results, to check certain pieces of evidence such as images, photographs and figures, to deduce the relevance and rigour of the approach implemented, and even to detect errors or shortcomings. Open

[6] See COMETS Opinion "Citizen Science" of 2015.

science should also help to circumvent the prohibitions in some countries where, for ideological and/or political reasons, the authorities oppose the dissemination of and access to research results on censored subjects such as global warming or theories of evolution[9].

The diversification of editorial channels

The opening up of publications is accompanied by a diversification of editorial channels through which knowledge is disseminated all over the world at any time. It therefore has a major impact on the communication of research work, which is an obligation for the researcher.

Let us recall the process of traditional scientific publishing: the researcher submits an article to a journal, the managing editor organises a peer review, the author corrects the article, then the editor prints, publishes and disseminates it in the journal. The vast majority of journals do not charge authors for publishing their paper[10]. Non-subscribing readers have access to the article through their university or institute libraries, which pay subscriptions to the journal's publishers. Clearly this traditional publishing model no longer meets the criteria for open access, although it is still the approach followed by most researchers, whatever their discipline. An exhaustive study shows a change over the last few years, indicating that globally 28% of the scientific literature published online can be freely accessed, but this figure depends on the editorial channel used, the publisher and the discipline[11]. Several models of scientific publishing are now available to researchers from the perspective of open science considered below.

The inalienable rights of scientific authors

Before explaining the complex relationship between research and publishing, it is useful to recall that since the French Act of 1 August 2006 [12], researchers are fully entitled to the moral and economic rights to their writings, even if they are civil servants. Annex 1 explains the

[7] Founded in 2010 by Alexandra Elbakyan, a Kazakh researcher, in order to disseminate more widely the scientific knowledge stored behind "paywalls", by March 2017 the Sci-hub data library hosted about 68.9% of the scientific literature referenced by CrossRef and 85% of the articles published by paying publishers. The worst hit publishers having filed a complaint, the original domain name (Sci-Hub.org) was deactivated in November 2015 following an American court decision. The project nevertheless resurfaced with alternative domain names in the following months. In April 2019, at Elsevier's request, a court decision forced Internet service providers to block the website, but other solutions were quickly found.

[8] See the synopsis of the symposium on scientific integrity and open science organised by the Office Français de l'Intégrité Scientifique (OFIS) that was held in Paris in April 2019.

[9] See the COMETS Opinion 2018-38, "Research: a global right".

[10] For some traditional subscription-based journals such as the Journal of Biological Chemistry or some economics journals, the publication of an accepted article generates an editing fee calculated in proportion to the number of pages published, without this implying open access.

[11] Heather Piwowar, Jason Priem, Vincent Larivière, Juan Pablo Alperin, Lisa Matthias, Bree Norlander, Ashley Farley, Jevin West, Stefanie Haustein, The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles, 13 February 2018.

legislation that protects the output of researchers in France. It also sets out the international rules where the copyright system applies.

Dissemination on the Internet of publications and, in general, of works authored by researchers (such as presentations or photos) has changed the way in which they are used since, once published on a website, anyone in the world can download, exploit, modify and republish a researcher's work. To address this situation, the non-profit NGO "Creative Commons" proposes licences (CC licences) that allow authors to make their works available to the public according to predefined conditions [13]. CC licences offer various options, detailed in Annex 1. COMETS reaffirms its support for the use of such licences to protect the writings and associated output of researchers.

Open access journals in search of an equitable model

There is an increasing number of open access journals. They use various business models, the technical nature of which is beyond the scope of this Opinion. They will be examined herein with respect to ethical concerns.

The need for peer reviews

There is a general consensus on the need for peer reviews whether for open access or subscription-based journals.

Peer reviews are usually organised by the journal's editor, who submits the article to reviewers not known to the author. These experts' assessment is the basis for the qualification of the manuscript in terms of its content, originality, writing and sources, a step prior to certification by the publisher before publication. COMETS has already highlighted the difficulties that this type of validation currently encounters given the increasing number of articles published, the pressure on deadlines exerted by some publishers, the unavailability of reviewers and, in certain very specific areas of study, the difficulty in finding experts who are either sufficiently qualified or have no interests arising from relationships with the authors.

The open science approach enables other forms of assessment to be investigated. Each has its own benefits and risks depending on the discipline involved [14]. In the case of "open" peer reviews, the reviewers make themselves known to the authors and can even initiate a discussion with them [15]. In the field of life sciences, the open access publishing platform Faculty of 1000 (or "F1000", see https://f1000research.com/) was a forerunner because it changed the traditional order, placing the peer review after publication on the website. Named

[12] See the French DADVSI Act on copyright and similar rights.

[13] For an exhaustive analysis, see: https://www.legalstart.fr/fiches-pratiques/proteger-une-creation/Creative-Commons/. These licences are structured around four options, detailed in Annex 1.

reviewers are then invited to comment on the paper via the website. No remarks are anonymous.

Some disciplinary fields go so far as to consider dispensing completely with publication in a journal that holds peer reviews because the wealth of the discussion among the experts concerned appears to them sufficient to qualify the value of the research work available in open access format. New but less radical procedures are used by other journals, which allow spontaneous discussion, open to all online, of the preprint so that the authors can then submit an improved text to reviewers for validation. This procedure makes publishing slower but reduces the rejection rate and thus facilitates the publisher's task[16]. The recent initiatives of BioRxiv in partnership with various publishers may also be highlighted. We can also point out the forthcoming partnership between BioRxiv and Review Commons, a foundation-funded platform which 17 journals have agreed to use for peer reviews prior to a paper's submission to the journal. Authors will thus be able to deposit their preprints and choose either to accept or not the posting of reviews. The service, which is free of charge, will also allow authors to include an answer and make changes.

Article Processing Charges (APCs)

Article processing charges are made to cover the publishing costs incurred—i.e. sending the paper to the reviewers, formatting, online publishing, referencing and archiving. These costs are the responsibility of the publisher and subject to different payment formulas. These formulas are often referred to collectively as the "gold route"[17].

Some publishing houses ask for payment of APCs as soon as the manuscript is accepted; in rarer cases payment is required on submission. These charges are paid by the researchers-authors, their team or their laboratory out of the funds allocated to their research, by their host institution or organisation, or even by the project funder when there is one. It should be noted that in some countries, research institutions are beginning to negotiate financial agreements with some prestigious publishers, thereby obtaining significant cost offsets for their researchers (see below). Prestigious journals can ask for extremely high APCs[18]. In September 2018, a coalition of 11 major European scientific agencies (now 16), including the ANR, proposed a policy known as "Plan S" concerning publications resulting from work funded by public research contracts[19] (see Annex 2). In particular, it recommends capping

[14] See David Pontille, Didier Torny. From Manuscript Evaluation to Article Valuation: The Changing Technologies of Journal Peer Review Human Studies, Springer Verlag, 2015, 38 (1), pp. 57-79

[15] This is the case, for example, for the Frontiers publishing house. See Tony Ross-Hellauer, What is open peer review?A systematic review

[16] See the methods developed by Copernicus, a publishing house for geosciences. These methods are now being adopted by other specific disciplinary fields such as nuclear magnetic resonance. It should be noted that these new journals improve the "gold route" publishing system, but do not exempt the researcher from paying APCs, which are, however, lower than the charges for current open access journals.

[17] It should be noted that many gold route journals do not require a financial contribution from the authors because their funding is provided by patrons, associations, or other sources.

APCs so they remain “reasonable”, thus limiting the exorbitant profits of some major publishers[20] [21].

An unfair hybrid model

Most of the major scientific publishers (Elsevier, Springer, Wiley, etc.) now offer what they call “hybrid” journals. Some of their traditional subscription-based journals offer opportunities that bring them into line with the rules of open science. Authors can choose to publish their article online for open and immediate access subject to the payment of often considerable additional publishing charges[22]. This model is very profitable for the publisher as researchers end up paying an extra charge in addition to the subscription fees paid by their host organisation. Unfortunately, the current limitations of open access encourage some researchers to take this route if they can afford it and if they want their work to be published without delay. It should be noted that Principle 8 of Plan S signed in 2018 formally advises against using this hybrid model. However, some ongoing revisions of Plan S, considered by many to be too restrictive, appear to envisage the hybrid model as acceptable in particular cases (see Annex 2)[23].

Payment of APCs by researchers: ethical issues

The fairness and ethics of open access journals that require the payment of APCs may be questioned. Indeed, the merchandising of scientific findings in our market economy system generates a substantial and growing profit for publishers. However, the product sold by publishers is provided to them free of charge by researchers, themselves generally paid by the public service and therefore by the taxpayer. What is more, peer reviews are also carried out free of charge by the same community that provided the product that generates the publisher's profit. When scientists are forced to pay to make their findings known, they surreptitiously move from the role of authors to that of publishing house customers. COMETS is duty-bound

[18] The APCs paid by researchers to publish their work in a “major” open access journal represent on average €3,800 per article according to data published by the Efficiency and Standards for Article Charges (ESAC) initiative, and can be as much as €5,000 or more. Charges are lower when the publisher is a learned society, such as the Physical Review or the American Physical Society.

[19] Plan S is an initiative launched by Science Europe in September 2018 in order to promote open access to publications on the basis of a set of ten principles, including the obligation to publish all scientific publications that result from research funded by public national or European grants in compliant open access journals or on compliant web platforms. See Annex 2.

[20] A study published by EPRIST in March 2016 shows that the world’s top six scientific publishers—Elsevier, Wiley, Wolters Kluwer; Thomson Reuters, Taylor & Francis and the Springer Nature group—generate cumulative sales of €7.5 billion (organic growth of 2.9% over 2014), i.e. 38% of global scientific publishing sales ,estimated at €23,billion. These six publishers moreover capture 65% of the profits generated worldwide by scientific publishing due to exceptional operating margins of more than 36% on turnover.

[21] According to international financial reporting standards in 2018: Elsevier, revenue of £7,492 million, operating profit of £1,905 million; Wolters Kluwer, revenue of €4.260 million, operating profit of €961 million; Thomson Reuters, revenue of $5.501 million, operating profit of $780 million (25% decrease due to exceptional costs linked to the separation of F&R business).

[22] Some prestigious journals require up to €3,000 more.

[23] It should be noted that some so-called “transformative” models of negotiations between publishers and research institutions can also be seen as part of a hybrid model if they involve traditional subscription-based journals (see below).

to raise the question of the fairness of this system, which generates undue profits for publishers by drawing on a significant proportion of public investment in research. Indeed, this model helps exacerbate inequalities to the benefit of researchers with the most resources and the best networks. For those who are awarded national and European contracts, expenses related to APCs and publishing house profits are in principle currently provided for in their overall funding, but this is at the expense of salary expenditure and/or investments. Teams that do not have contracts, for whatever reason, have to use their core funds to pay for open access publication of their articles unless they are published in journals having signed an agreement (see below). It is to be feared that a "winner takes all" momentum will be initiated whereby those who have contracts are more likely to publish, and therefore to obtain more contracts through a chain reaction. We must also address the issue of colleagues and collaborators in less favoured countries. For them, the risk is twofold: a two-tier research system and the temptation, for some, to publish in unreliable journals due to their attractive rates.

The danger of the multiplication of 'predatory' journals

Alongside journals subsidised by learned societies or public authorities, there has been an increase in the number of publishing offers with reduced APCs. Their purpose raises a tricky issue, since it is in the interest of such journals to multiply the number of authors without worrying about either the number of readers or the intrinsic quality of the articles they publish. Many of these dubious journals do not hesitate to lure the researcher with a fictitious editorial board including renowned scientists who have not generally given their consent. A general warning has circulated against these so-called 'predatory' journals. It should be noted though that there is a continuum between high-quality journals and purely predatory journals[24]. In 2017, approximately 10,000 journals were published by more than 1,000 potentially predatory publishers. However, it is difficult to identify these journals and their publishers because of their ability to suddenly appear and disappear[25]. It is therefore highly recommended that researchers consult the list of open access journals[26] deemed internationally "valid"[27].

Publications are not the only targets of 'predators' who also attract researchers by inviting them to conferences that are themselves 'predatory'[28], providing very poor conference proceedings and with no recognition among the scientific community. Referencing these

[24] See, for example, the excellent CIRAD analysis of these dubious journals.

[25] Beall's list, put together by the University of Colorado, was a constantly updated list of predatory journals that, up until January 2017, provided at the same time the criteria used to define them. Closed due to a conflict with Frontiers media, it is now managed and supplemented by various websites, including Stop Predatory journals

[26] See the Directory of Open Access Journals (DOAJ) , freely accessible online. DOAJ is a non-profit organisation based in the United Kingdom and funded by donations. "DOAJ is committed to being 100% independent and maintaining all of its services and metadata as free to use or reuse for everyone".

[27] This term is undefined. 'Valid' journals are understood here as those in which a published article can be considered to have been validated by a high-quality peer review.

conferences, or alerts issued by INIST, for example, could help warn researchers and curb the spread of such practices.

Open archives or the “green route”: a model offering multiple possibilities

Open archives, known as the ‘green route’, were initiated by researchers themselves. They were created in 1991 through physicist Paul Ginsparq's brilliant idea for his discipline. Documents resulting from ongoing research work are deposited free of charge on a web platform. They are thus immediately accessible at no charge to readers, for whom they constitute a wealth of information. Many disciplines now have an international open archive. Examples include arXiv for physics and mathematics, astroPh for astronomy, RePEc for economics, chemRxiv for chemistry, bioRxiv for biology and the European interdisciplinary platform Zenodo.

The HAL online platform

The French multidisciplinary online repository known as HAL (*Hyper Articles en Ligne*) was created by the CNRS in 2001. It is currently supervised by the CNRS, INRIA, the University of Lyon and INRA. It achieved recognition as a national archive in 2013 and has since been directly funded by the French Ministry for Higher Education, Research and Innovation (MESRI)[29]. It makes available scientific articles, theses, working papers, conference papers, pictures, photographs, etc. It also hosts new types of open access journals such as Epi journals (see below). HAL is linked to a number of international archives. COMETS has supported the HAL archive through several of its Opinions[30]. The repository of author-accepted manuscripts (AAMs) in an open archive such as HAL is clearly recognised as one of the channels that comply with Plan S, provided that the AAM is registered under a Creative Commons licence and available immediately, without any embargo period.

Depositing articles in open archives is not an alternative to publication in peer-reviewed journals, but a supplementary practice. Researchers are strongly encouraged to deposit their papers on open archive platforms once they have been published in scientific journals. The assessment of research teams, laboratories and individual researchers at the CNRS, Inria and major universities is now based on publications referenced on the HAL open archive. Needless

[28] See, for example, the feature written by Daniel Bloch, “Alerte aux conférences prédatrices !” [Be warned of predatoryconferences!] in Reflets de la Physique no. 58.

[29] Ministerial press release on the national archive, HAL.

[30] COMETS Opinion of 2012 “Le libre accès aux publications scientifiques (“open access”)” [Open access to scientificpublications] and COMETS Opinion of 2016 “Discussion et contrôle des publications scientifiques à travers les réseauxsociaux et les médias ; questionnements éthiques” [Discussion and management of scientific publications through socialnetworks and the media: ethical issues].

to say, this is only legal once the embargo period imposed by certain publishers—who are obviously hostile to practices such as these that go against their interests—has elapsed. It should be noted that this period may not exceed six months in general and 12 months for the HSS[31].

Some teams are still encountering technical difficulties in depositing their work on HAL[32]. It is preferable that the procedure be simplified but at the same time secured from a legal point of view, in particular by ensuring the agreement of all co-authors, whether French or foreign. It would also be beneficial to extend automated simultaneous networking with other international archives[33]. The optimal interoperability of HAL and its services with other open archive systems such as ArXiv or RePEc is a key objective for open science, which can only increase the influence of French research. Articles published in French—particularly in the HSS—could thus be widely disseminated, making it more difficult for them to be plagiarised in English-language publications. The use of HAL should lead to the active involvement of researchers from all disciplines, their role being fundamental to platform's future development, setting aside the purely technical aspects taken care of by computer scientists and archiving professionals. Among the outlooks for HAL, it is hoped that the platform will become a lively forum for discussion of the published research deposited there. This obviously implies reasoned mediation by researchers, and implies that commentators do not remain anonymous, at least not for the moderators.

The risks and benefits of preprints

In some disciplines, researchers are making more proactive use of open archives by depositing preprints of their articles there. The panorama of these preprint servers has become much more complex in recent years[34]. Researchers make their paper available on the Internet at the same time as submitting it to a traditional or open access journal, and before it has been filtered by the journal's peer review process. This practice—condemned by some major publishers—is nonetheless very common and even almost systematic in certain disciplines such as physics, astrophysics, economics and mathematics. Researchers take the risk of contravening agreements imposed by major publishers, but they all do so without express permission. The advantage for authors is that their work is immediately disseminated to the whole target community. Most often, the scientific comments received help them improve the manuscript before it is even published, and date their work before that of their competitors. Successive preprints can thus follow one another until the final manuscript is published. In some cases, the article does not appear until much later, or even never if the author gives up meanwhile. However, the work will still be known to all those who are likely to find it of

[31] The French Digital Republic Act of 2016 sets the maximum embargo period for all research output of which at least 50% is funded by public grants, regional authorities, public insttutions, national funding agency grants or EU funds.
[32] Difficulties in depositing work on HAL relate, for example, to the complexity of references for articles with multiple authors.
[33] The connection is automatic for some disciplines, and works from HAL to ArKiv for example, but not from HAL to RePEc.

interest, and it can be cited—especially if it has a permanent digital object identifier (DOI)[35]. Another advantage of preprints put forward by authors such as physicists and astrophysicists, is that they thus consider themselves released from their obligations to open access publishing even if they entrust their manuscript to a journal that does not offer open access. Though valid in principle, this solution does not offer a definitive solution to the economic issue of opening up publications, as someone still has to pay the journal's subscription fee. Often this is the library of the researcher's host institution.

Some disciplines rarely have recourse to preprints, and some are even resolutely hostile to them, particularly in certain fields of the HSS. The risk most often mentioned is that of being copied or plagiarised before a manuscript is accepted and certified by a journal, whereas depositing a preprint actually allows the work to be dated. In addition, some communities fear that they will be overwhelmed by poor-quality output—which is in fact quite rare within disciplines that make extensive use of preprints. It should also be noted that recourse to preprints renders double blind peer reviews ineffective. Practised by a number of journals and conferences, both the reviewer and the author remain anonymous to each other in this approach, but if the authored article becomes accessible to all then all anonymity is lost. Some journals even refuse any article published as a preprint, stating that is not original. Yet practices evolve under the pressure of researchers, if they are as collectively motivated as physicists were in their harsh battles of the past: prestigious journals such as Physical Review and Physical Review Letters have for many years now accepted the practice of depositing articles on ArXiv before they are published. Major publishers such as Oxford University Press[36] and Springer Nature[37] have also taken a step along this policy path.

The stimulating discussions revolving around a research subject before it is ultimately finalised as a peer-reviewed article are to be encouraged: the manuscript is enriched for it benefits from the correction of mistakes, from additional insights, relevant quotations, suggestions and the like. Moreover, critical opinions can avoid the duplication of existing work or highlight inappropriate methods, thus providing an additional means of ensuring greater scientific integrity. Preprints can also be used to date ongoing research or to advance an idea before having fully explored it: the risk of others "borrowing" research in this way may thus be offset by the protection offered by public dissemination. This can be seen as a benefit of openness and finally a strong driver of research.

[34] See the Knowledge Exchange report, "Accelerating scholarly communication. The transformative role of preprints", 10.5281/zenodo.3357727

[35] The famous articles by Grigori Perelman, which resulted in him being awarded the Fields medal (refused), were never published elsewhere than on ArXiv, for example.

[36] For all its academic journals, Oxford University Press specifies that "prior to acceptance for publication in the journal, authors retain the right to make their original version of the article available on their own personal website and/or that of their employer and/or in free public servers of original version articles in their subject area, provided that, upon acceptance, they acknowledge that the article has been accepted for publication".

[37] https://www.nature.com/articles/d41586-019-01493-z

However, it is important to clarify the difference between preprints and certified publications in journals, especially for the media always on the lookout for new discoveries. Preprints can obviously convey false or inaccurate information that will be detected by peer reviewers when a manuscript is submitted to a journal. Some results can also be presented too quickly by the authors, who will then correct their findings through successive versions on the website. Some see this as an intrinsic flaw of the open archives used to deposit preprints. This flaw should be corrected by a label clearly indicating the latest peer-reviewed version certified by the journal that published it.

The unattainable "diamond route": models to discover

The payment of APCs is not the only way of funding open access publishing. There are many business models in which neither readers nor authors contribute to the publishing infrastructure[38]. In order to distinguish them from formulas entailing APCs, they are often referred to as the "diamond route". This may appear to some to be a morally satisfactory objective, in that it does not generate unfair practices. However, in the market economy system in which open science is set to develop, the complete absence of processing charges can only be considered utopian. Editorial work must be paid for and the expenses incurred are unavoidable. However, this principle can stimulate the search for solutions.

Some publishing models are leaning towards the "diamond route"

On an international level, one of the closest models to the "diamond route" is that of OpenEdition[39], a comprehensive electronic publishing infrastructure serving the HSS. Articles that have been validated and certified through publication in a subscription-based journal are published in html version without any embargo period on this vast platform, where they are accessible free of charge. What is known as a "freemium" subscription offer is made to university libraries which, if they accept it, can then offer their users the PDF version of articles published on this online platform. Several CNRS Editions journals are published on the OpenEdition platform[40]. Also noteworthy is the ISTE Group's OpenScience platform, an innovative publishing model for scientific and technical journals covering most scientific fields. Most of the articles are published in French without any subscription or financial participation by the author. A rapid expert appraisal is carried out by the editorial board in order to publish the articles within eight to ten weeks[41].

[38] See Peter Suber's book, "Open Access", available through open access.

[39] OpenEdition has been a national and international joint research unit since 2004. It has a catalogue of over 500 journals and 8,000 books.

There are also other initiatives to support the publishing of books or articles, registered respectively in the Directory of Open Books (DOAB) or the Directory of Open Access Journals (DOAJ)[42]. Of the 13,759 journals listed in the DOAJ, 10,032 do not charge for processing. Other forms of (shared) support may be offered. It should also be noted that publishers may be able to make money from the added value extracted from the articles published in their journal, for example through text mining[43]. While the publishing process has to be paid for, there is no need for the author to pay for it directly.

"Transformative" agreements negotiated by research institutions

In addition to the initiatives we have just examined, the public researcher's host organisation can also intervene. It can pay the publishing house for the professional processing of the manuscripts submitted: either it undertakes to pay APCs directly to open access journals, or it negotiates with subscription-based journals to have the articles of their own author-researchers published on an open access basis. In several European countries, research organisations negotiate such 'transformative' agreements with a number of commercial publishers. In Germany, key institutions such as the Max Planck Society, the Helmholtz Institutes and major universities have already begun to negotiate agreements with publishing houses such as Wiley and Springer Nature[44].

It should be noted that, generally speaking, agreements such as those concluded by public research institutions concern only a limited number of major publishing houses and one type of discipline. They could thus restrict the researchers' choice of journal in which to publish their findings.

In France, such direct 'transformative' negotiations between publishers and research institutions are not yet the rule. For 20 years, the COUPERIN consortium has been coordinating all negotiations with commercial publishers[45]. These negotiations do not, however, appear to be undertaken from an open science viewpoint.

---

[40] CNRS Editions publishes mainly books, but also some HSS journals that benefit from the CNRS's editing assistance.

[41] The best papers are selected by the editorial board and disseminated worldwide in English with Wiley or Elsevier as a co-publisher.

[42] DOAJ(https://doaj.org/) is an online directory that indexes and provides access to high quality, peer-reviewed open access journals. It is independent; its funding is via the donations of sponsors and publisher members.

[43] Some journals host articles free of charge in exchange for the possibility of using their content for technology watch purposes for customers. This can go beyond text mining if these articles also provide data and codes. See, for example the Opscidia startup.

[44] Information provided by Gerard Meijer, Director and Scientific Member of the Fritz Haber Institute of the Max Planck Society in Berlin, in charge of DEAL (DEutsche Allianz Lizenzen) negotiations with a number of major scientific publishers. Under the terms of these agreements, costs are paid globally by all the institutions concerned, which each provide a percentage of their total research budget for this purpose. The advantages for their researchers, as both authors and readers, are appreciable: they no longer have to pay any fees or to transfer their manuscript's copyright to the publisher as this is part of the overall negotiation. However, the limitations of such a model cannot be ignored: in the case of a subscription-based journal that initiates an open access scheme, the model is hybrid and the commercial publisher is paid twice.

[45] COUPERIN negotiates subscription rates for all 264 HE&R instittions, including the CNRS. The rates usually apply to bundles of journals offered by each publisher, only some of which are freely accessible. The agreements are signed for several years at a time.

For innovative initiatives in scientific publishing

The League of European Research Universities (LERU) made its standpoint very clear when it stated that "Research funding should go to research, not to publishers!"[46]. It has called on key institutions to transform expenditure on subscriptions into investments, appealing to the inventiveness of the scientific community to regain control of the publishing system. In France, this message was relayed in October 2017 by a group of French scientists and representatives of the publishing world. Their call for open science and 'bibliodiversity', known as the "*Appel de Jussieu*"[47], encourages the development of innovative initiatives to open up not only publications but also data (see Annex 3). COMETS endorses the recommendations of this call, especially the request to allocate resources to researchers working on projects to create open publishing tools. In this respect, mention should be made of the support that the ANR has just provided to teams developing innovative open access data platforms[48].

Recent open access publishing initiatives include epi journals that are free for both author and reader. These journals rely solely on researchers and do not involve private publishers. The epi journal online platform is hosted by the HAL open archive, but unlike the vast majority of documents deposited on HAL, all epi journal articles are subject to peer review, organised by specialised 'epi panels' (currently about 15). These panels call upon high-level researchers with recognised expertise in their field to review the articles. A steering committee monitors the epi panels and is in charge of coordinating the hosted journals and the platform. A national committee certifies the epi journals through a label. The number of applications is constantly rising and the epi journals in question often address very specific fields[49]. These epi journals can be seen as a kind of ideal 'diamond route', but the time spent by researchers on running the system—the cost of which is ultimately borne by their research institution—cannot be ignored. There is also the question of how to assess a researcher publishing in these epi journals (see below) and how to assess the epi journal itself.

In a similar vein, we should also mention the Peer Community in (PCI)[50] initiative launched by a number of communities. This requires depositing preprints on open archive platforms such as bioRxiv or arxiv.org. The authors of a preprint deposited in these archives can then request its assessment by a 'Peer Community in' competent in the discipline concerned, e.g. 'Peer Community in Evolutionary Biology', or the very recent 'Peer Community in Genomics'[51]. The only condition applied is that this preprint is not already published or under review by a journal. A 'recommender' (the strict equivalent of a journal publisher) of the PCI solicited

[46] See the LERU website"Christmas is over..."
[47] "Appel de Jussieu", a call for open science and bibliodiversity. See Annex 3.
[48] See the ANR's "flash" project in 2019, which led to over 100 innovative proposals for opening up data and 25 prize winners awarded a budget of €2.3 million.
[49] See the principle behind epi journals at epi science.org

will then initiate a critical review if he or she considers the article of interest. The preprint—or a revised version if necessary—can be recommended on the basis of at least two (a priori external) reviewers' reports. The reports, recommendations and DOIs of the successive and corrected preprint versions will be visible free of charge to readers on the website of the Peer Community in concerned, as will all correspondence with the authors. The recommendations themselves are published and signed, making each PCI a kind of meta-journal that their authors can capitalise on as an original output. This procedure entails more than simply depositing a paper on an open archive in that some of the articles on the platform have been peer-reviewed. Unlike epi journals, PCIs do not compete with the current journal system. They obviously only work for a small community, but enable more interdisciplinary assessments than the usual journals.

Many other initiatives are being developed around original solutions for making publications whose peer review was organised by the editorial board of a subscription-based journal freely available without processing charges. It should be noted that these are journals and fields, generally in the HSS, which have little market value. As we saw earlier, a remarkable example of this kind of mixed initiative is OpenEdition. In the field of life sciences, the open access publishing platform Faculty of 1000 (or "F1000", see https://f1000research.com/) was a forerunner because it changed the traditional order, placing the peer review after publication on the website. Named reviewers are then invited to comment on the paper via the website. No remarks are anonymous.

Mention should also be made of the SCOAP approach in the field of high-energy physics[52]: CERN set up an international network including funding agencies, institutions and libraries to provide open access to six journals covering 80% of all the articles in this field.

There are also various forums for discussing research findings or ideas; these are more like blogs. One example is the 'Hypotheses' platform, which has about 1,000 HSS members.

The wealth of initiatives aiming to disseminate research findings is commendable. However, it is important to be aware of the risk of dispersal and even fragmentation of information so as to address the challenge of traceability. These publishing initiatives take up a great deal of researchers' time, whether they participate in a journal's scientific committee or are engaged in the design of a new publishing model. COMETS recommends that institutions, and in particular the CNRS, recognise the importance of such activities in the assessment of researchers, in team budgets and in the research institution's communication. The proposed solutions, which must be given time to develop, should be assessed and widely disseminated if

[50] PCIs are funded by universities, learned societies, French or foreign laboratories and laboratories of excellence ('labex'). Many research institutions, including doctoral schools, laboratories, laboratories of excellence and assessment boards have publicly affirmed their support for the PCI project and consider articles recommended by a PCI to be of the same level as an article published in an international peer-reviewed journal.

[51] https://genomics.peercommunityin.org/

[52] SCOAP : Sponsoring Consortium for Open Access Publishing in Particle Physics. SCOAP^3 converts high-quality journals in the field of high-energy physics to open access by redirecting subscription funds.

they appear valid and effective. Feedback, which promises to be both rich and inventive, deserves official recognition and systematic review at regular intervals. Such specific assessment of open science developments should lead to the proposal of an ad hoc committee.

The assessment of researchers in the framework of open science

The assessment of individual researchers, their team or their laboratory is primarily based on their publications. The shortcomings of the exclusive use or misuse of bibliometric criteria[53] [54] have already been widely criticised. Indeed, it is known that the factors qualifying researchers' publications (e.g. the length of their publication list or the reputation of the journals concerned) are not only unsatisfactory for assessing their work but may also be biased. Many countries, such as China and India, have set up an incentive system that directly relates career advancement and laboratory funding to the number of papers published in prestigious international journals[54]. Although the situation has not reached such extremes in Europe, the pressure to publish in this type of journal, whatever the cost, remains very strong in all disciplines[55].

The misleading indications of the journal impact factor

Is it really necessary to recall that journals base their reputation to a large extent on their impact factor? [56] The latter, promoted by the major publisher Thomson Reuters, was originally created as a guideline for librarians so as to identify which journals to purchase. The limitations of this parameter as a research assessment tool are now well documented: the impact factor is only an average established over a large sample of articles in a wide range of fields, some of which are never cited while others are cited a great deal; the average value of this factor varies enormously from one field to another, which favours certain disciplines; moreover, it can be manipulated by certain publishers[57]; finally, calculated over the two years following publication of the articles, it does not reflect the long-term impact of the published work.

[53] See A. Molinié & G. Bodenhausen, "Bibliometrics as Weapons of Mass Citation", Chimia no. 64: pp78-89. Molinié-Bodenhausen-Bibliometrics-Chimia-64-78-2010.pdf

[54] "Major" commercial publishers are also measuring the potential of these new research players ready to do whatever it takes to publish in their journals. They can expect a significant increase in profits due to the impressive numbers involved.

[55] All this is actually one of the main causes of breaches of scientific integrity according to Pierre Corvol's report for MESRI in 2016.

[56] More accurately, the impact factor of a journal is the ratio between the number of citations of that journal in a given year for articles published in the previous two years and the number of articles published by that journal in those same two years.

The San Francisco Declaration on Research Assessment (DORA)[58] indicates the misuse of this impact factor. It makes 18 recommendations to organisations and researchers on the adoption of good practices for assessing the quality of individual research articles, evaluating the contributions of a particular scientist, or making decisions concerning recruitment, promotion or funding (see Annex 4). The Leiden Manifesto[59] subsequently formulated ten general principles that can help bibliometric indicators to be better used for research assessment purposes (see Annex 5).

It should be noted that the improper use of the impact factor only consolidates the strong position of the major scientific publishers, whose turnover increases with the number of articles published. In this respect, the strategy of Nature Publishing Group is edifying, as it multiplies the number of titles by dividing research up into specialist fields. It is therefore in the interest of publishers to push for an increasing number of publications, a movement that contradicts the current policy of research institutions such as the CNRS which, having signed DORA, strongly encourage researchers to focus on the quality of articles rather than their quantity.

While the assessment of research is necessarily based on its impact—at least partially—this may strongly depend on the disciplinary context and, within a discipline, on the temporality used to "measure" a breakthrough (depending, for example, on whether the research is closer to or further from an actual application). This explains why, to date, nothing can replace a qualitative and collegial approach. The assessment undoubtedly draws on more quantitative elements, including journal impact factors and citation indices of papers written by the person being evaluated. Not only are these indicators criticised as good publication assessment[60], but they do not adequately reflect research communicated through channels other than scientific journals. Without suggesting restarting illusory work on bibliometrics, more thought could be given to how the impact of articles can be monitored through their citations in all scientific communication media due to the possibilities that have been opened up through open access and text mining techniques.

For more reliable, more open research practices

The new publishing practices being set up, awareness of the excesses to which the "publish or perish" policy has led, and the diversification of researchers' activities all prompt a profound

[57] Some publishers ask authors to cite articles from the journal in which they hope to publish their own paper.

[58] DORA, the San Francisco Declaration on Research Assessment published in 2013, calls into question the increasing use of bibliometrics in the assessment of research and researchers.

[59] The Leiden Manifesto for Research Metrics (2015), Diana Hicks et al., Nature, 2015, 520, 429-431

[60] See, for example, the analysis of Hirsch index biases in CNRS and CPU guidelines. Other factors for measuring the impact of publications have been suggested, especially by physicists, but they do not appear to be more relevant than the h-index

reform of the research assessment system, as underlined in the Jussieu call for open science and bibliodiversity. COMETS indicates herein some avenues of improvement.

New practices need to be implemented by both researchers and the publishing world in order to develop robust research. As highlighted at the last World Conference on Research Integrity in Hong Kong (June 2019)[61], a special effort should be made to improve the reliability of published findings[62]. On this depends the possibility of building tomorrow's science on solid foundations. The reliability of scientific results is crucial everywhere, in all areas of research. Recent surveys tend to prove that many published results cannot be reproduced from one team to another, or even by the researcher who originally produced them[63]. This is sometimes the case of scientists who, in certain disciplines such as medicine or the humanities, misuse statistics. Such biases have disastrous consequences on the image of research and the public's trust in it. The pressure to "publish or perish" is one of the causes. It is essential to take the time to complete the research, i.e. to reach fully conclusive results, before publishing them. For some, this means improving statistical evidence beyond the standards usually required, for example. It is also important to be as explicit as possible about the conditions under which the research was carried out so that it can be reproduced and verified in the future. In some experimental or survey-based fields, it is very useful to preregister[64] protocols so that the proposed method may be evaluated prior to any experimentation. Mainly implemented in biomedical sciences, preregistration is also developing in the HSS, particularly in fields such as psychology and sociology. The 'replicability' or reproducibility of research protocols should be a key concern in some disciplines.

It should be noted that improving the quality of scientific output also involves repeating previous work for validation purposes. However, approaches of this type—to be distinguished from the repetition of other people's work—are considered of little value, whether by publishers, who always want something new, or by researchers themselves, who fear a negative judgement when they are assessed. They are nevertheless extremely useful for proving the integrity and reliability of research findings.

Another important issue is the dissemination of negative results, often abandoned for fear of rejection by the publisher. The resulting loss of information can be very damaging, for example in medicine: studies of this type with the required authorisations to study cohorts of patients remain unknown whereas they could be useful for patient healthcare or could help avoid duplicating experiments and therefore wasting the time of other research teams. All these results need to be easily accessible[65]. However, it is feared that a publication in the conventional sense of a written text, is no longer sufficient, and consideration should perhaps be given to a formalised representation of research findings that would not only be in written

[61] The 6th World Conference on Research Integrity (WCRI) in Hong Kong (2019) led to the drafting of a manifesto for assessing researchers.
[62] The reliability of reported results is crucial for 'cleaning up' publications.
[63] Estimating the reproducibility in psychological science, Science, 2015, 349, 6251. Is there a reproducibility crisis? Nature, 2016, 25, 452-454
[64] See, for example: https://openaccess.univ-rennes1.fr/les-revues-predatrices Preregistration entails submitting researchconditions to a peer review before beginning work.

form but would be automatically searchable. Remember that it is always possible to use various other forms of communication for results (reports, expert appraisals, personal diaries, blogs, etc.). Special recognition should be given to researchers who play the transparency game by publishing their results—whether positive or negative—in open access format.

Finally, the Hong Kong Manifesto began looking at the societal value of open science. It thus praised all the contributions made by researchers to social well-being and stimulating the intellectual curiosity of their fellow citizens. COMETS hereby reaffirms its full agreement with these objectives.

What solutions for open access to publications?

Having focused on the publication of articles, as announced, this Opinion has only addressed some of the problems posed by the opening up of research results. Open access to books has not been discussed. Our analyses should be supplemented by considerations on the opening up and sharing of data and codes.

COMETS considerations stem from its standpoint on ethics and integrity. After discussing and analysing the different modes of open access, while we prefer the ideal model known as the 'diamond route', we are nonetheless fully aware that the problems—especially financial ones—that this model poses are far from being solved. In any case, it appears that the scientific publishing system of the future will be diversified, benefiting from the multiple solutions currently being trialled that can potentially be combined. Researchers, their host institutions and publishers will need to reach an agreement at both national and international levels. The recommendations put forward by COMETS are in line with these considerations.

More generally, it appears that, beyond the editing and publishing aspects of these new modes of scientific publishing, they are bound to modify research practices. This is why the 'Peer Community in' groups, by virtue of the publishing formula they offer, are increasingly seen as scientific forums ensuring the quality of the papers they make accessible since scientific results are commented on, amended and probably improved prior to any publication in a journal. Furthermore, once published, scientific discussions may continue on line between the authors and reviewers if the peer review was carried out in open mode. Little by little the individual work submitted is transformed into a collective work. Its status is thus modified, and we must reconsider the very notion of 'author', which imperceptibly shifts from an individual to a group that is difficult to define, particularly in the current framework of assessment bodies. COMETS needs to address the ethical dimension of this type of changes in research practices.

RECOMMENDATIONS

- To foster the emergence of new scientific publishing initiatives
- Provide resources to researchers and teams working on innovative initiatives designed to implement new open access models, and factor these initiatives into their assessment.
- Enable researchers to appropriate new initiatives such as epi journals and PCIs through information provided by dedicated CNRS services.
- To develop open archives
- Enable journal-certified articles to be deposited in open archives whatever the discipline and in accordance with legislative requirements.
- Facilitate deposits on HAL. It is preferable that the procedure be simplified but at the same time secured from a legal point of view, in particular by ensuring the agreement of all co-authors, whether French or foreign.
- Increase researchers' involvement in the running and development of HAL.

- Consider that the platform may become a lively forum for discussion of the published research deposited there.
- Ensure the interoperability of HAL with all international open archives for all disciplines and in all directions, i.e. from HAL to other archives and from other archives to HAL.

- To improve research and research assessment practices
- Pay particular attention to the reliability of research results by encouraging wider dissemination of methods, protocols, algorithms, etc.
- Encourage researchers in disciplines such as medical sciences or sociology, etc. to preregister their hypotheses and protocols.
- Encourage wider dissemination of research findings, including negative results and validation of previously published work, through various publishing platforms, epi journals, etc.
- Require that assessment bodies apply DORA principles.

- Encourage deliberations on the new opportunities offered by open science for assessing the impact of published articles through their citations in all the tools of scientific communication now available.
- Take into account when assessing researchers not just their publications but all the means used to communicate their results: reports, journal clubs, conferences open to the general public, personal blogs, data, open source software, etc.
- Encourage researchers and reviewers to consult the directory of open access journals (DOAJ) that are considered valid on an international footing and to learn more about predatory journals.

- To foster an open relationship between research and private publishing
- Inform the scientific community on the progress of negotiations conducted by COUPERIN.

- Inform researchers about their intellectual property rights as well as the conditions for transferring their rights to publishers. Raise researchers' awareness of the benefits of Creative Commons licences.

ANNEXES

ANNEX 1: copyright

In France

In France, copyright protection covers literary works, including researchers' articles and books, graphic creations and software. This protection begins from the day on which the article or book was written, without further formalities, i.e. before its publication. Copyright explicitly protects researchers by granting them two kinds of rights. Firstly, moral rights protect the researcher as the author of an original work. These moral rights are specifically perpetual, inalienable and imprescriptible. Researchers are thus entitled, in particular, to respect for the integrity of their work (i.e. third parties are not allowed to modify it), and to the authorship of their work (i.e. third parties have to cite the author). Secondly, economic rights give researchers a monopoly on the economic exploitation of their work. They are thus entitled to prohibit or authorise the use of their writings and to receive remuneration in return. In France, these economic rights expire 70 years after the author's death.

Worldwide

Researchers are often led to publish outside France, especially in Anglo-Saxon countries. This has a significant impact on the rules of copyright protection. Indeed, apart from the United Kingdom, Cyprus, Ireland and Malta (which fall under Anglo-Saxon copyright legislation), copyright rules based on what the French call "*droit d'auteur*" (literally 'author's rights') apply in European countries. In common law countries such as the UK, USA, Canada and Australia, the Anglo-Saxon copyright system applies to all intellectual property, whether industrial, literary or artistic. This implies that the work must be registered in order to benefit from the '©' sign. The Anglo-Saxon notion of copyright differs substantially from the '*droit d'auteur*' copyright system in that it is supported by an economic rationale: it therefore favours the producer or publisher of the work over the researcher. As a result, unlike in countries where '*droit d'auteur*' copyright applies, in countries where Anglo-Saxon copyright applies, the researcher's moral rights are both alienable and limited in time. In this case, the publisher who has acquired the researcher's output can freely choose what to do with it.

Harmonisation through the Berne Convention

However, we should not overlook the role of the Berne Convention of 1886, revised several times since then and signed by 177 countries, including France, Canada and the United States[66]. This text seeks to harmonise Anglo-Saxon copyright and '*droit d'auteur*' copyright legislation on an international scale. The writings of scientists are protected by '*droit d'auteur*' copyright, since Article 2 § 1 of the Convention indicates that "*the expression 'literary and artistic works' shall include every production in the [...] scientific [...] domain, whatever may be the mode or form of its expression, such as books, pamphlets and other writings; lectures, addresses, sermons [...] illustrations, [...] plans, sketches and three-dimensional works relative to [...] science.*" The World Intellectual Property Organization (WIPO) indicates that protection is based on the principle of "national treatment". It states that "*works originating in one of the Contracting States (that is, works the author of which is a national of such a State or works first published in such a State) must be given the same protection in each of the other Contracting States as the latter grants to the works of its own nationals*"[67]. This means that an English researcher, for example, benefits from the same protection in France as a French researcher. A French researcher who publishes an article in Canada or the United States has the same protection as Canadian or American researchers. In this respect, it should be added that the Convention requires signatory States to respect minimum standards of protection in their policies. There is therefore a minimum protection of the moral rights of authors, which allows them to claim authorship of their work and oppose any kind of modification.

Free licences

The development of "free licences" also raises the question of researchers' rights over their own creation. Free licences are contracts of adhesion in which the researcher (the licence holder) cannot discuss its terms and must comply with the commitments therein. Free licences vary greatly. A relationship is established between the original author of the work and each licence holder. As M. Clément-Fontaine explains, any licence holder who modifies the work—as so authorised by virtue of the licence—is granted copyright protection on original contributions. These contributions may in turn be the subject of a free licence that grants others the same freedom. The users of the modified work are then bound by contract not only to the original author, but also to the authors of modifications to the original work[68]. French legislation ratifies the notion of a free work in art. L. 122-7-1 of the Intellectual Property Code, according to which "the author is free to make his/her works available to the public free of charge, subject to the rights of any co-authors and those of third parties, and in compliance

[66] List of Contracting States: https://www.wipo.int/treaties/en/ShowResults.jsp?treaty_id=15.
[67] https://www.wipo.int/treaties/en/ip/berne/summary_berne.html

with the agreements (s)he has entered into". The protection of moral rights depends on the terms of the licence and the type of moral right involved. A licence may, for example, consider that the right to authorship can be claimed both by the original author and by all the researchers having signed the licence. On the other hand, the right to the integrity of the work poses such problems that it can be considered that by agreeing to the terms of the licence, the researcher will be unable to exercise this right.

Creative Commons licences

For an exhaustive analysis, see: https://www.legalstart.fr/fiches-pratiques/proteger-une-creation/Creative-Commons/. Licences are structured around four options:

- Attribution: Those who use your work may reproduce, distribute and communicate it freely, provided they expressly credit you with authorship. This condition applies to all CC licences.
- No commercial use: you authorise those who use your work to reproduce, distribute or modify it for non-commercial purposes only. If a user wishes to use your work for commercial purposes, they must obtain your permission.
- Sharing under the same conditions: your work may be reproduced and modified to create derivative works, but these must be published under the same conditions as your original work. Anyone wishing to publish an adaptation under other conditions must obtain your prior permission.
- No modifications: you authorise only the reproduction and distribution of your original work, without modification. Your consent is required for any translation, alteration, transformation or reuse in another work.

ANNEX 2: Plan S

Drawn up by cOAlition S (an international consortium of 16 national research funding agencies in Europe—including France's ANR—which have joined forces to foster open access publishing), this plan has been structured around ten principles. A key principle is that research funded by public grants should be published in compliant open access journals or platforms.

The ten principles of Plan S

1. authors unreservedly retain copyright protection for their publications, which must be published under an open licence such as those proposed by copyright protection for their publications, which must be published under an open licence such as those proposed by for their publications, which must be published under an open licence such as those proposed by *Creative Commons*; the licence applied must in all cases fulfil the requirements defined by the Berlin Convention;

[68] M. Clément-Fontaine, "L'oeuvre libre", JCL. Fasc. 1975, 2014, no. 15.

2. coalition members establish robust criteria and prerequisites for open access compliance of journals and platforms;
3. they encourage the creation of compliant open access journals and platforms where there are none;
4. any publishing costs are covered by funders or research institutions, not by individual researchers —it is acknowledged that all researchers should be able to publish their work in an open access system;
5. publication fees must be standardised and capped (in Europe);
6. coalition members encourage governments, universities, research organisations, libraries, academies and learned societies to align their strategies, policies, and practices, notably to ensure transparency;
7. The above principles apply to all types of scholarly publications, but for books or monographs, the deadline may be extended beyond 2021;
8. the importance of open archives and repositories is acknowledged (for their long-term archiving function and their potential for publishing innovations);
9. the 'hybrid' model of open access journals is not compatible with the key principle;
10. coalition members must monitor compliance with the plan and sanction non-compliances.

To enable text and data mining, the full content of the article must be in machine-readable format (e.g., XML). The members of cOAlition S are also committed to adapting the criteria applied when assessing researchers and research outputs. The coalition also emphasises the importance of transparency concerning costs and in particular open access publishing fees.

Amendments to Plan S

Plan S first required scientists and researchers receiving project funding from research organisations and institutions to publish their work in an open access format by 2020. Following the numerous criticisms raised by the first version of Plan S, several revisions and clarifications now make it a more realistic and applicable plan[69]. Let us look at the most important measures:

- The implementation deadline has been postponed by one year to 1 January 2021.

- The depositing of author-accepted manuscripts (AAMs) in an open archive such as HAL is clearly recognised as one of the channels that comply with Plan S, provided that the AAM is registered under a Creative Commons licence and available immediately, without any embargo period.
- cOAlition S clearly supports new publishing initiatives or modes such as 'diamond' open access.

- The funding of publication in hybrid journals is no longer automatically excluded. It remains possible on condition that these journals form part of open, 'transformative' agreements such as 'publish and read', and may be signed up to late 2024.
- The need to revise research assessment methods—particularly in the early stages of researchers'

[69] https://www.inserm.fr/actualites-et-evenements/actualites/open-access-nouvelle-version-plan-plus-realiste-et-applicable

- careers—has been identified. This requires new international evaluation rules to be laid down.

ANNEX 3: The Jussieu call for open science and bibliodiversity-[70]

- Open access must be accompanied by support for the diversity of players involved in scientific publishing—i.e. bibliodiversity—thus putting an end to domination by a small number who dictate their terms to scientific communities;
- The development of innovative scientific publishing models must be a budgetary priority as an investment to obtain services that correspond to researchers' real needs in the digital age;
- Support should be given to experiments focusing on writing practices (publication of associated data), expert appraisal procedures (open reviews), editorial services on content (web publishing beyond PDF) and additional services (text mining);
- Research assessment systems must be profoundly reformed and geared to new scientific communication practices;
- There should be greater, coordinated investment in the development of the open source tools on which these innovative practices are based;
- The scientific community needs a stable and secure legal framework in the different countries in order to benefit from efficient text mining services for scientific publications, which intensify their use;
- Scientific communities must have access to national and international infrastructures that guarantee the preservation and circulation of knowledge against any privatisation of content. It is necessary to find business models that will ensure the sustainability of these systems;
- Priority should be given to business models that do not involve payment either by authors (to publish) or by readers (to access texts). Many equitable business models exist, whether based on institutional support, the involvement or subscription of libraries, the marketing of premium services, crowd-funding or the constitution of open archives. Such models are just waiting to be extended and generalised.

ANNEX 4: The San Francisco Declaration on Research Assessment (DORA)

The signatories of the San Francisco Declaration on Research Assessment support the adoption of the following practices for research assessment:

General recommendation

1. Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring,

[70] "Appel de Jussieu", a French call for open science and bibliodiversity.

promotion, or funding decisions.

For funding agencies

1. Be explicit about the criteria used in evaluating the scientific productivity of grant applicants and clearly highlight, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.
2. For the purposes of research assessment, consider the value and impact of all research outputs (including datasets and software) in addition to research publications, and consider a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice.

For institutions

1. Be explicit about the criteria used to reach hiring, tenure, and promotion decisions, clearly highlighting, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.
2. For the purposes of research assessment, consider the value and impact of all research outputs (including datasets and software) in addition to research publications, and consider a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice.

For publishers

1. Greatly reduce emphasis on the journal impact factor as a promotional tool, ideally by ceasing to promote the impact factor or by presenting the metric in the context of a variety of journal-based metrics (e.g., 5-year impact factor, EigenFactor, SCImago, h-index, editorial and publication times, etc.) that provide a richer view of journal performance.
2. Make available a range of article-level metrics to encourage a shift toward assessment based on the scientific content of an article rather than publication metrics of the journal in which it was published.
3. Encourage responsible authorship practices and the provision of information about the specific contributions of each author.
4. Whether a journal is open-access or subscription-based, remove all reuse limitations on reference lists in research articles and make them available under the Creative Commons Public Domain Dedication.
5. Remove or reduce the constraints on the number of references in research articles, and, where appropriate, mandate the citation of primary literature in favour of reviews in order to give credit to the group(s) who first reported a finding.

For organisations that supply metrics

1. Be open and transparent by providing data and methods used to calculate all metrics.

2. Provide the data under a licence that allows unrestricted reuse, and provide computational access to data, where possible.
3. Be clear that inappropriate manipulation of metrics will not be tolerated; be explicit about what constitutes inappropriate manipulation and what measures will be taken to combat this.
4. Account for the variation in article types (e.g., reviews versus research articles), and in different subject areas when metrics are used, aggregated, or compared.

For researchers

1. When involved in committees making decisions about funding, hiring, tenure, or promotion, make assessments based on scientific content rather than publication metrics.
2. Wherever appropriate, cite primary literature in which observations are first reported rather than reviews in order to give credit where credit is due.
3. Use a range of article metrics and indicators on personal/supporting statements, as evidence of the impact of individual published articles and other research outputs.
4. Challenge research assessment practices that rely inappropriately on Journal Impact Factors. Promote and teach best practice that focuses on the value and influence of specific research outputs.

ANNEX 5: the Leiden manifesto

1. Quantitative evaluation should support qualitative, expert assessment.
2. Measure performance against the research missions of the institution, group or researcher.
3. Protect excellence in locally relevant research.
4. Keep data collection and analytical processes open, transparent and simple.
5. Allow those evaluated to verify data and analysis.
6. Account for variation by field in publication and citation practices.
7. Base assessment of individual researchers on a qualitative judgement of their portfolio.
8. Avoid misplaced concreteness and false precision.
9. Recognise the systemic effects of assessment and indicators.
10. Scrutinise indicators regularly and update them.

QUALIFIED PERSONS CONSULTED

We mention here only some of the qualified persons with whom we have had discussions and whose knowledge has enriched this Opinion. We would like to thank each and every one of them.

Francis André, engineer, deputy director of DIST (CNRS)

Pierre Corvol, medical doctor and biologist, chair of the French Academy of Science

Marin Dacos, computer scientist, consultant on open science for MESRI

Serge Bauin, engineer, task officer at DIST (CNRS)

Blandine Genthon, director of CNRS Editions

Thomas Guillemaud, agrobiologist in charge of a 'Peer Community in' programme

Agnès Henry, director of EDP Sciences

Denis Jérome, physicist, member of the French Academy of Science

Claude Kirchner, computer scientist, Inria emeritus research director, member of the Epi sciences steering committee, member of the CCNE

Olivier Le Gall, agronomist, chair of the *Conseil Français de l'Intégrité Scientifique* (CoFIS) – advisory board of OFIS (*Office Français de l'Intégrité Scientifique*)

Lionel Maurel, lawyer, deputy science director at the INSHS (CNRS)

Didier Torny, sociologist, task officer at DIST (CNRS)

Glossary of abbreviations or acronyms used

ANR: Agence Nationale de la Recherche (French Research Agency)

APC: Article Processing Charge

CC: Creative Commons

CC-BY: Creative Commons attribution

CIRAD: French Agricultural Research Centre for International Development

cOAlition S: international consortium behind Plan S, an initiative proposed by research organisations

DIST: *Direction de l'Information Scientifique et Technique du CNRS* (CNRS's Scientific and Technical Information Directorate)

DADVSI (French Act): *Droit d'auteur et droits voisins dans la société de l'information* (title of the Act leading to a law on author's rights (copyright) and related rights in the information society)

DEAL: DEutsche Allianz Lizenzen

DOAB: Directory of Open Access Books

DOAJ: Directory of Open Access Journals:

DOI: Digital Object Identifier

DORA: Declaration on Research Assessment

EPRIST: Association of scientific and technical information heads within research institutions

HE&R: Higher Education & Research

IFRS: International Financial Reporting Standard

ESAC: Efficiency and Standards for Article Charges

HAL: *Hyper Articles en Ligne* (link to online articles)

INRA: *Institut National de la Recherche Agronomique* (National Institute for Agricultural Research)

LERU: League of European Research Universities

AAM: Author-Accepted Manuscript

MESRI: *Ministère de l'Enseignement Supérieur, de la Recherche et de l'Innovation* [French Ministry for Higher Education, Research and Innovation]

OFIS: *Office Français de l'Intégrité Scientique* [French Scientific Integrity Office]

WIPO: World Intellectual Property Organization (UN)

PCI: Peer Community in

SCOAP: Sponsoring Consortium for Open Access Publishing in Particle Physics.

HSS: Humanities and Social Sciences

WCRI: World Conference on Research Integrity