

UNESCO issues a powerful endorsement of Open Science

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Convened in 1999 under the aegis of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and of the International Council for Science (ICSU), the World Conference on Science adopted a [Declaration on Science and the Use of Scientific Knowledge](#), which stated that “in the 21st century, science must become a shared asset benefiting all peoples on [the] basis of solidarity.” In its wake, the 2002 [Budapest Open Access Initiative](#) put forward by a group of visionary academics, librarians, and publishers issued a statement of principle, strategy, and commitment that introduced the paradigm of *open access* publishing. The subsequent [Bethesda Statement on Open Access Publishing](#) by members of the biomedical research community as well as the [Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities](#) issued by the Max Planck Society and the European Cultural Heritage Online project on behalf of over 120 cultural and political organizations from all over the world, spawned a movement that has been transformative for academic publishing ever since: by now, almost a half of scholarly publications are open access (Figure 1).

In 2018, a group of national research funding organizations, with the support of the European Commission and the European Research Council, announced the launch of [cOAlition S](#),^{*} an initiative to make full and immediate open access to research publications a reality:

With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional, and international research councils and funding bodies must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo.

However, Open Science also benefits science itself. As Marc Schiltz, one of the architects of [cOAlition S](#), put it:²

Science, as an institution of organized criticism, can... only function properly if research results are made openly available to the community so that they can be submitted to the test and scrutiny of other researchers. Furthermore, new research builds on established results from previous research. The chain, whereby new scientific discoveries are built on previously established results, can only work optimally if all research results are made openly available to the scientific community.

The European Union-funded [FOSTER](#) project aims to “contribute to a real and lasting shift in the behavior of European researchers to ensure that Open Science... becomes the norm.” It runs an e-learning platform that contains much of what one may wish to know about the [taxonomy](#) of Open Science.

The latest major international development concerning Open Science took place at the 41st session of UNESCO’s General Conference, which issued, on November 23, 2021, a [Recommendation on Open Science](#), with the aim “to provide an international framework for open science policy and practice.”

In this 36-page document, UNESCO recognized “the urgency of addressing complex and interconnected social and economic challenges for the people and the planet,” acknowledged “the vital importance of science, technology, and innovation (STI) to respond to these challenges,” and noted “the transformative potential of open science for reducing the existing inequalities in STI.”

UNESCO’s *Recommendation* defines Open Science

as an inclusive construct that combines various movements and practices aiming to make multilingual

^{*} The “S” stands either for Science or Shock but could stand for (Marc) Schiltz or his colleague (Robert-Jan) Smits. More on Plan S can be found [here](#).

scientific knowledge openly available, accessible, and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation, and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors, and open dialog with other knowledge systems.

Thus, Open Science concerns (a) scientific publications (open access publication platforms), (b) research data (made available in accordance with the Findable, Accessible, Interpretable, and Reusable (FAIR) principle), (c) educational resources (to be released with open license permits that enable no-cost access, use, adaptation, and redistribution), (d) software (to be released under a license that allows modifications, derivatives, and sharing), and even (e) hardware (such as design specifications of apparatus, tools, and samples):

A paywalled method of publication, where immediate access to scientific publications is only granted in exchange for payment, is not aligned with the present *Recommendation*. Any transfer or licensing of copyrights to third parties should not restrict the public's right to immediate open access to a scientific publication.

Access to scientific knowledge should be as open as possible. Access restrictions need to be proportionate and justified. They are only justifiable on the basis of the protection of human rights, national security, confidentiality, the right to privacy and respect for human subjects of study, legal process and public order, the protection of intellectual property rights, personal information, sacred and secret indigenous knowledge, and rare, threatened, or endangered species.

Last but not least, Open Science requires an infrastructure comprised of journals (such as this one), publication platforms, repositories (such as ArXiv, ChemRxiv, or bioRxiv, etc.), and bibliometric and scientometric systems that enable "assessing and analyzing scientific domains."

The *Recommendation* also lists the core values and guiding principles of Open Science. These are shown diagrammatically in Figure 2.

We conclude by noting that there has been a proliferation of online publications that pretend to be both scientific and open access, but are, in fact, neither.³ These are not difficult to tell apart from the bona fide ones (as it is not difficult for "predatory" conferences). Their existence

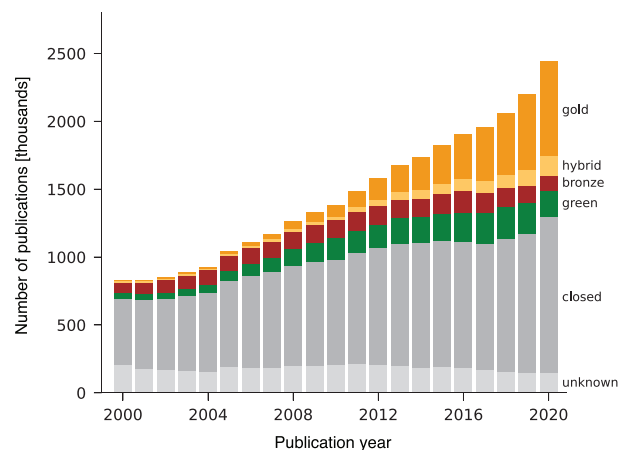


FIGURE 1 Global publication output by open access category. Based on the Web of Science. Only included are document types 'article' and 'review,' see Ref.¹ The color-coded open access categories are explained for instance [here](#).

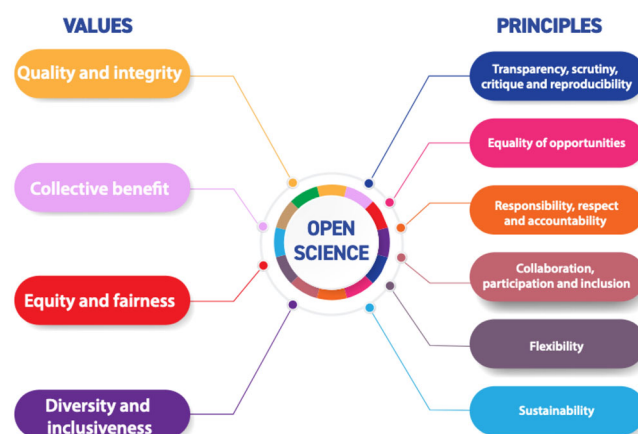


FIGURE 2 Core values and guiding principles of Open Science as defined by UNESCO's *Recommendation*

should not diminish our enthusiasm for Open Science or blind us to seeing its immense benefits. Predatory or fake journals have nothing to do with Open Science.

The business model of open access publishing relies on charging for publishing rather than for reading, as has been (mostly) the case within the subscription model. Commonly, article processing charges (APCs) are requested from the authors, although alternatives have been put in place as well. Since publishing research results is an integral part of the research enterprise, the costs of publishing fall under the expenditures for research. Academic institutions and research funders have to acknowledge this and make fund allocations specifically for the purpose of open access publishing. Authors are being increasingly relieved from paying APCs individually by collective agreements of their research institutions and funders with publishers. These are on the level of universities, their consortia ([University of California system](#)), or even whole countries ([Projekt DEAL](#) in Germany).

However, many countries have not yet embraced open access publishing. While funders in these countries allow expenditure items for attending conferences (typically with an annual cap), APCs are either not yet allowed, or there is quite a restrictive cap on their total annual cost.

Within the open-access business model, it is in the interest of the publishers to ramp up both the APCs and the quantity of the papers published. While keeping the APCs under control is an issue primarily for the research funders to deal with, it is up to the editorial boards to ensure that only quality papers get accepted for publication. Nevertheless, the editorial boards should also see to it that APCs charged by their journals are transparent. It is, therefore, essential that the editorial boards of Open Science journals are independent of their publishers and assume the role of the publishers' critical partners. Only then can Open Science journals provide a service to the research community it needs and deserves.

We embrace UNESCO's *Recommendation on Open Science* and stand for independent editorial boards. We believe we are one.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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