

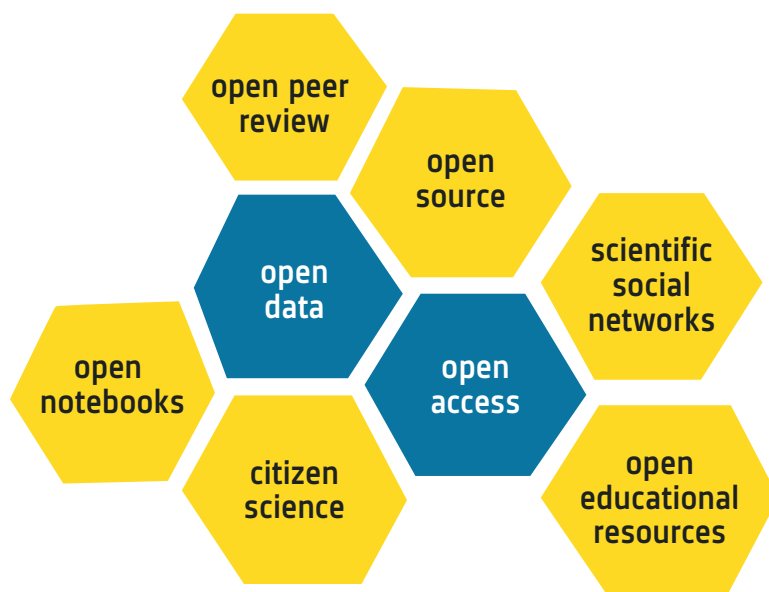
Open Science in Switzerland: Opportunities and Challenges

Open Science stands for a new approach to the scientific process, based on cooperative work and new ways of making knowledge available. It is thus an umbrella term for various movements aiming to remove the barriers to sharing any kind of output, resources, methods or tools, at any stage of the research process (Figure 1).¹ Here, we focus on the open access to scientific literature and to data because of their particularly high relevance to the scientific community in Switzerland, at which this factsheet is primarily addressed. Both Open Access and Open Data are important science policy topics in different parts of the world, but the developments in Europe are most pertinent for Switzerland. This factsheet therefore presents the issues at stake in the on-going discussion in Europe and Switzerland, points out opportunities and addresses challenges. The recommendations are guided by the key consideration to shape Open Access and Open Data so that they foster scientific progress and benefit society.

Exchange and openness have been at the heart of modern science since its inception in the 17th century. The first types of science communication, with the goal of spreading scientific information, were scientific journals that scholarly societies published. In the 20th century, tools such as the World Wide Web, the preprint repository arXiv.org² and research organisations like CERN were established in the spirit of sharing science. By the beginning of the 21st century, digitalisation increased the opportunities for spreading scientific literature and data. While exchange and openness in scientific publishing did not develop at the same rate everywhere and for everyone, the Open Science movement serves as a catalyser of change.

The on-going debate in Europe and Switzerland to advance Open Access and Open Data is part of a global discussion. Different stakeholders have specific capacities and responsibilities to contribute to this endeavour. Taking due account of the different perspectives, this factsheet points out the opportunities and challenging issues. Its recommendations are addressed to relevant stakeholders, i.e. policy-making, higher education institutions, research funders, libraries, publishers, the scientific community and scholarly societies.

Figure 1: Elements of Open Science



Open Access

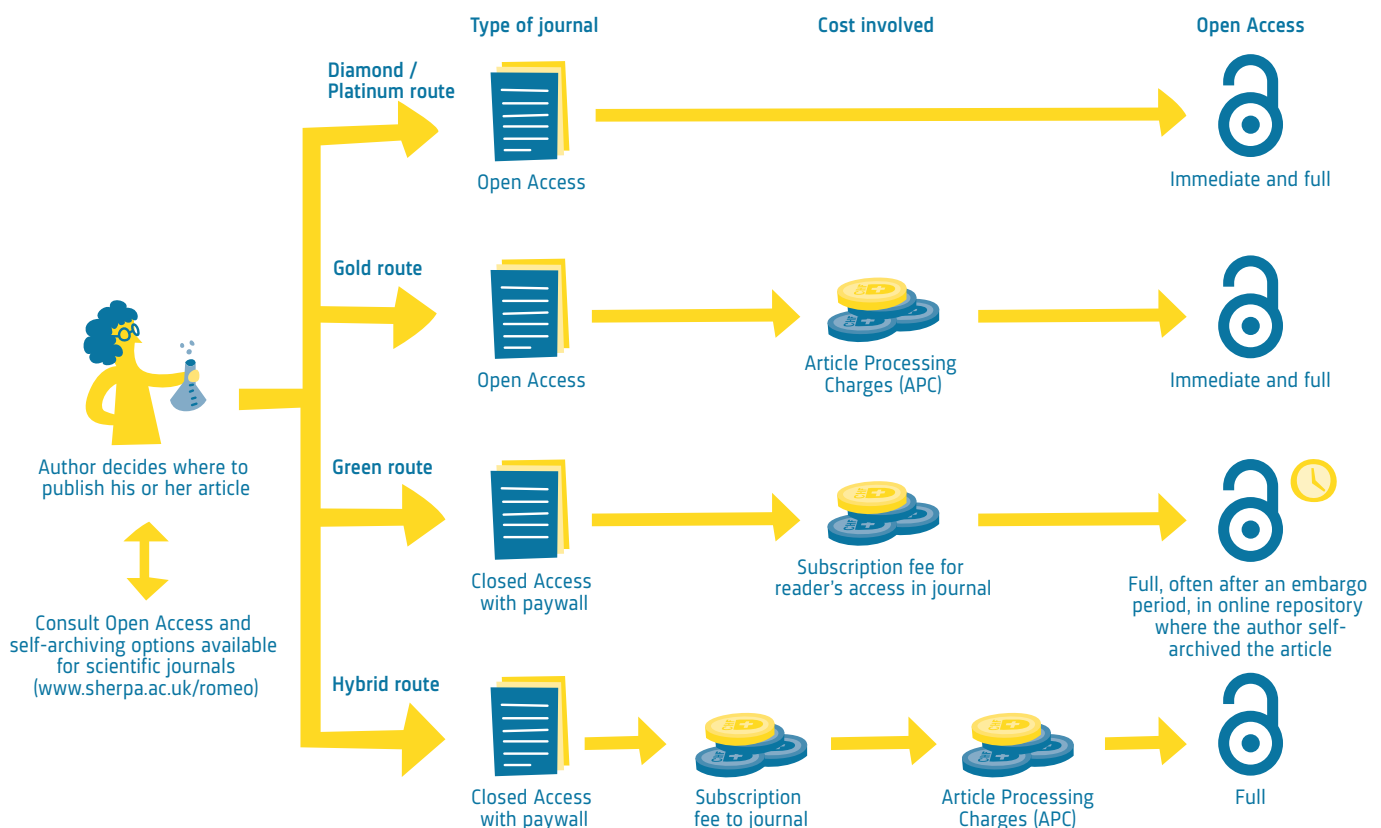
In Europe

The Open Access movement emerged bottom-up, with the scientific community aiming to open up access to knowledge and help accelerate its dissemination. This resulted in three widely supported milestone statements, of which the Berlin Declaration (2003)³ is probably the most cited, and Open Access platforms and tools such as BioMed Central⁴ and PLOS (Public Library of Science)⁵ were developed in the early 2000s, although the former became part of a major publishing group years later. The ambition to regain some control over publications in scientific journals by overcoming the dictate of a few large international publishers – Elsevier, Springer, Wiley-Blackwell, Taylor & Francis, SAGE – became part of the Open Access movement only at a later stage. This development catalysed the establishment of Open Access publishing platforms, e.g. Frontiers⁶ and ScienceMatters⁷ in Switzerland. Nonetheless dissatisfied with the slow progress, a scientist developed Sci-Hub⁸ in 2011 with now more than 70 million freely accessible papers. In contrast to the other initiatives mentioned so far, Sci-Hub is illegal because it ignores all applicable copyright and legal regulations. The use of Sci-Hub, however, is not illegal in Switzerland. Considering research and its results as a public good, the policy-making and funding sector also picked up Open Access and gave additional impetus.

The European Commission's Open Science agenda (2016)⁹ has been critical in this process, in that it called for full Open Access for all scientific publications. Plan S, which intends to boost Open Access, was jointly launched in 2018 by Science Europe, a group of national research funding organisations

in Europe, and the European Commission.¹⁰ Plan S received positive reactions¹¹ and important national and philanthropic research funding agencies beyond Europe pledged their support, e.g. China and India, or signed it, e.g. the Gates Foundation. In the consultation on Plan S, however, concerns were also raised. Scientists argued that they were no longer allowed to publish in journals of their preference, and that it had negative implications for the evaluation and reward system of their work.¹² ALLEA, the European Federation of Academies of Sciences and Humanities, asked for a broader consultation with all relevant parties in order to avoid unintended consequences under the new scheme, particularly regarding the ability of early career scientists to obtain grants and promotions.¹³ Taking into account the different feedback, Plan S was amended in 2019. Accordingly, as of 2021, more than a dozen research funders and the European Research Council (ERC) that subscribe to Plan S are committed, inter alia: i) to ensure that authors retain the copyright of their publication with no restrictions; ii) to cover Open Access publication fees where applicable; and iii) to phase out the transitional hybrid journal model, which allows large international publishers and major scholarly societies to continue generating substantial profits from publishing articles in and from scientific journal subscriptions ('double dipping'). While the original Plan S stated that funding for Open Access fees should be "standardised and capped", the revised version speaks merely of the "potential standardisation and capping of payments of fees". Finally, the parallel publication in online repositories (Green model; Figure 2) remains possible without an embargo period. The Swiss National Science Foundation (SNSF) supports, but has not yet signed Plan S, because it adopted its own new Open Access policy in April 2018 that allows for Green Open Access with embargoes, in line with the National Open Access Strategy for Switzerland.

Figure 2 'Open Access models for publication of articles in scientific journals'



In Switzerland

Various Open Access initiatives in Switzerland reflect the developments in Europe. Related to research projects that the SNSF funds, self-archiving of publications and Open Access to monographs are mandatory. Funding is provided for so-called Article Processing Charges (APCs) for Gold Open Access journals since 2014.¹⁴ The SNSF revised its Open Access regulations in 2018 with the goal to reach 100% Open Access by 2020.¹⁵ The 'Open Access Strategy' with the associated 'Action Plan' that swissuniversities, the rectors' conference of Swiss universities, jointly developed with the SNSF (2017–2018), pursues several measures to implement Open Access at all Swiss higher education institutions.¹⁶ Swissuniversities is committed to implementing this strategy by 2024. The Swiss Academies of Arts and Sciences promote Open Access through supporting and promotional measures, notably by setting the goal of Green and Gold Open Access until 2020 for the more than 80 funded periodicals in the humanities and social sciences.¹⁷

Opportunities

Open Access aims to facilitate access to all published scientific findings for anyone interested, notably scientists, thereby having more impact and supporting scientific progress. The collective storage of Open Access publications allows text

mining, i.e. systematic literature searches, to an extent that is otherwise inconceivable. iris.ai¹⁸ is one such tool that provides scientists access to the scientific literature beyond the capacities of current bibliographic databases such as PubMed¹⁹ or Google Scholar²⁰. Further advances in Artificial Intelligence will almost certainly foster new ways to explore knowledge stored in scientific publications.

Challenges and Recommendations

Open Access needs to be promoted globally, with publishers and higher education institutions giving the opportunity to anyone anywhere, both inside and outside academia, to publish scientifically relevant results. Given the focus of this factsheet, the following section recommends how to deal with important elements of Open Access so as to strengthen it in Switzerland.

Open Access models

- Diamond, Gold and Green: Research funders and publishers promote schemes in order to ensure the widest possible dissemination of scientific results through immediate and full Open Access whenever possible. They further explore alternative ways of publishing by seeking Diamond Open Access or a corporate funding model.²¹ They apply Green Open Access with no or a very short embargo pe-

riod to scientific journals, and also to monographs in the social sciences and humanities, where APCs do not usually cover publication costs.

- Diamond and Green: Research funders and publishers promote these models for disciplines where APCs are not yet established. In such cases, funding comes from research funding agencies or libraries, such as in the case of the Open Library of Humanities.²²

Financial matters

- Fair price: Publishers of scientific journals set Article Processing Charges in due proportion to the work carried out and make them transparent. Scholarly societies separate membership dues from the subscription fees to the scientific journals that they publish.
- Library subscriptions: Library consortia negotiate so-called 'transformative agreements' with international publishers with the aim to shift their payments from subscription-based reading of published material towards Open Access publishing.
- Publication sector: Research funders, scholarly societies and scientists shape the publication landscape with business models that prevent mono- and oligopolies, and where commercial publishers are financially accountable for contractually agreed services.

Quality issues

- Assessments and rewards: Research funders and higher education institutions value scientists' Open Access publications equally to their publications in subscription journals when assessing and rewarding their work, in line with the San Francisco Declaration on Research Assessment (DORA Declaration²³; Box 1).
- Quality assurance: Scientists ensure peer-reviewing for Open Access publications. Higher education institutions and research funders contribute to shaping an institutional and financial framework that discourages the establishment of predatory journals that exploit Open Access publishing by "charging publication fees to authors without providing the editorial and publishing services associated with legitimate journals".²⁴

Reuse of publications

- Secondary publication: Parliament enacts a secondary publication right for authors and their scientific publications²⁵
- Copyright: Authors retain the copyright of their work, which they publish under a Creative Commons (CC) license.²⁶ The preferred license is CC-BY, the most accommodating of licenses, allowing others to distribute, remix, tweak and build upon this work as long as credit is given to the author of the original creation.

Digitisation and preservation

- Non-Open Access journal stocks: Editors, scholarly societies, publishers of scientific journals and libraries recognise the importance of the longevity of scholarly periodicals, digitise paper versions and make them accessible Open Access on trusted repositories, such as E-Periodica.ch²⁷.
- Persistent Identifiers (PIDs): Publishers, editors and scientists use PIDs like DOI (Digital Object Identifier), ORCID,

handles or ARK²⁸ when journal articles do not automatically attribute PIDs (e.g. PubMed ID, arXiv ID) in order to facilitate searchability and shareability of scientific work.

Box 1 'SNSF and DORA'

The SNSF has signed the **San Francisco Declaration on Research Assessment (DORA)**, which recommends funders to be explicit about the criteria used in evaluating the scientific productivity of applicants, thereby considering the **scientific quality, value and impact of their entire research output** (including datasets, software, prototypes) in addition to research publications. In this context, the **scientific content of a paper is much more important than publication metrics** or the name of the journal in which it was published. Within the scope of this evaluation, the scientific discipline, academic age and personal situation (e.g. career breaks, care duties) of the applicants will be considered.²⁹

Open Data

In Europe

The discussion on the open access to scientific data followed that on open access to scientific publications. Open Data aims to make primary and secondary data³⁰ related to publicly funded research available for reuse by a wider community to enhance the quality and integrity of scientific work. In this context, stakeholders from academia, industry, research funders and publishers developed the FAIR Principles to make data findable, accessible, interoperable and reusable.³¹ The European Commission launched the European Open Science Cloud (EOSC) with the ambition, by 2021, to offer "1.7 million European researchers and 70 million professionals in science and technology a virtual environment with open and seamless services for storage, management, analysis and reuse of research data, across borders and scientific disciplines".³² Related to the EOSC, Science Europe developed a set of core requirements for Data Management Plans (DMPs) in an attempt to align the increasing variety of research data management policies and requirements of different research funders.³³

In Switzerland

National stakeholders in research and education foster Open Data in different ways. The swissuniversities funding programme 'Scientific information: access, processing and safeguarding' promotes the development of Open Data supporting services such as research data management solutions and repositories.³⁴ The SNSF Policy on Open Research Data

introduced the Data Management Plan in 2017 whereby researchers need to outline in their project applications how they will generate, collect, document, share and preserve related data.³⁵ In addition, the SNSF undertook a landscape survey on researchers' use of research data and repositories to identify current needs.³⁶ The Academies organised several events in 2018 to raise awareness in the scientific community on Open Data and engage scientists in the shaping of framework conditions:

- **Academy of Sciences (SCNAT):** A conference in Brussels, organised on behalf of the European Members of the International Science Council and with ALLEA (European Federation of Academies of Sciences and Humanities), emphasised the need for reliable data repositories, train-

ing of data managers and for a change in scientific culture towards a state where data sharing is integral to the scientific practice.³⁷ A data management workshop in Bern argued that one size does not fit all scientific disciplines and that the involvement of the scientific community in defining and implementing best practices on Open Data is critical.³⁸

- **Academy of Humanities and Social Sciences (SAHS):** A conference in Bern addressed special issues for research platforms in the humanities on how to meet Open Data and FAIR Data requirements and, in particular, which standards have to be taken into consideration.³⁹ Several higher education institutions have established dedicated Open Data websites with guidance for researchers (Box 2).

Box 2 'Open Data websites of Swiss higher education institutions'

- **EPF Lausanne** researchdata.epfl.ch
- **ETH Zurich** www.explora.ethz.ch/en/s/open-data
- **University of Basel** researchdata.unibas.ch/en
- **University of Bern** unibe.ch/university/services/university_library/services/open_science
- **University of Fribourg** unifr.ch/research/en/open-science/open-data.html
- **University of Geneva** unige.ch/researchdata/en
- **University of Lausanne** unil.ch/openscience/en/home.html
- **University of St Gallen** www.unisg.ch/en/universitaet/bibliothek/dienstleistungen/researchdatamanagement
- **University of Italian Switzerland** desk.usi.ch/en/node/3556
- **University of Zurich** www.hbz.uzh.ch/en/open-access-und-open-science/data-services.html
- **University of Applied Sciences and Arts Western Switzerland HES-SO** hes-so.ch/en/open-hes-so-10501.html

The implementation of Open Data also relies on repositories. Several of them exist already or are in the process of being established in Switzerland:

- All disciplines: Swiss Data Science Center⁴⁰, Zenodo⁴¹
- Humanities: DaSCH⁴²
- Social sciences: FORSbase⁴³

More than 2200 research data repositories worldwide in the online registry re3data.org⁴⁴ are browsable by subject, content type and country.

Opportunities

In addition to the opportunities related to Open Access, Science Europe suggests that "quality-assured research data are key building blocks of the research process".⁴⁵ As promoted by the FAIR Principles and requested by the European Code of Conduct for Research Integrity⁴⁶, Open Data enables data mining and facilitates the reuse and reproducibility of research findings, thereby fostering the robustness and integrity of scientific findings. Furthermore, applying the FAIR scheme entails the potential to do science more effectively and address research questions in unprecedented ways due to the interoperability of data between different disciplines and their availability for reuse in dedicated infrastructures. Recognising its economic value, the private sector is already tapping into Open Data, e.g. Google recently launched the toolbox 'Dataset Search' that allows searches across a multitude of online data repositories.⁴⁷ The Open Science community criticises this toolbox as a closed system that capitalises on the work by scientists, without them having a say.⁴⁸

Challenges and Recommendations

With the ambition of furthering Open Data, the following recommendations address challenges that need to be tackled.

Securing access

- Repositories: Government agencies and research funders establish long-term funding mechanisms for field specific data repositories that allow the secure and reliable storage of large digitised data volumes as well as support data storage and sharing.
- Storage: Government agencies ensure that digitised material remain in the public realm.

Quality issue

- Reliability: Data repositories and scientists ensure the quality of Open Data through adequate and standardised review mechanisms.

Curation and reuse of data

- Funding and training: Research funders and higher education institutions provide means for the curation of quality Open Data. Higher education institutions develop certified degree programmes and train 'data stewards' accordingly,⁴⁹ and they offer continuing education courses in research data management for scientists at all career levels.
- FAIR Principles: Scientists, higher education institutions and research funders apply the FAIR Principles. Scientists develop disciplinary-specific good practices for the entire life cycle of data to ensure quality Open Data that enhances their reusability as well as text and data mining. Persistent Identifiers are set to enable efficient citing.

Evaluation

- Assessments: Higher education institutions and research funders take into account the datasets published by the scientists, whose work they assess.
- Reward systems: Higher education institutions give credit to the work of data stewards and to scientists who establish and maintain data resources.

The Web links referenced in this Factsheet are included in the online version at www.swiss-academies.ch/factsheets

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