UNIVERSITY
OF COLOGNE

Principles for OPEN SCIENCE

OPEN SCIENCE

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1. OPEN SCIENCE FROM THE PERSPECTIVE OF THE UOC

The University of Cologne (UoC) is committed to a free and open scientific culture, which encompasses open sharing, transparency, and reproducibility. The aim is to enhance the quality and impact of research and higher education as well as societal benefits and trust in science. To strategically develop and promote this culture of openness, UoC establishes Open Science as a guiding principle.[1]

Open Science in research and education requires new (digital) competencies and the revision of traditional practices. The UoC is aware that the transformation process to Open Science may vary over time and in the degree of openness due to differences in disciplinary fields.[2]

To establish the **values** and **practices** of an Open Science culture at UoC, the following measures will be implemented:

1. the existing **Open Science Principles** will be **regularly** adjusted to correspond to the dynamic development of the transformation, **at least every three years**,[3]
2. the **consulting** and **training services** on Open Science at the UoC are continually being developed;
3. an overview of current **activities and further information** on the topic of Open Science at the UoC will be presented on a website;
4. the responsibility for Open Science on behalf of the Rectorate lies with the **Vice-Rectorate for Research.**

1.1 What is Open Science?

Open Science is to be understood as a comprehensive and inclusive concept that aims at making scientific knowledge of all disciplines transparent and accessible to the public, including the underlying research materials (data, methods, software) as well as the processes of gaining, evaluating and communicating research results.[4]

1.2 Why is Open Science important?

Open Science aims to **address global societal challenges**[5], to promote a culture of collaboration across disciplines and boundaries, and to enable access to and transfer of knowledge through open practices.

Open Science contributes to scientific integrity by increasing transparency in the research process and by improving the reproducibility of research results. The communication and dissemination of research results also serve to strengthen trust in science.

Publicly funded research results and teaching are a public good and should therefore – in compliance with legal and ethical framework conditions – be accessible for reuse by third parties in the spirit of **sustainability**. Society benefits from Open Access to research findings because decisions can be made based on the latest scientific insights.

Open Science enables access to scientific knowledge regardless of available financial resources. This promotes **equal opportunities** and **collaboration between institutions and individuals**. Globally accessible research findings significantly enhance **knowledge transfer and the visibility of research**, not only

[1] This document is based on the structure and partially also on the content of the Open Science Policy of the University of Zurich, 2021. https://www.openscience.uzh.ch/en.html CC-BY 4.0)

[2] Wagner, Nick et al.: Die Öffnung der Wissenschaft. Werkheft zur Gestaltung der Transformation. Berlin: innOsci, 2021, p.13.

[3] Details on further measures will be documented in an internal implementation plan.

[4] This definition as well as the following description of the OS values and principles are essentially based on UNESCO: Recommendation on Open Science, 2021. https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en

[5] See Wagner, Nick et al., 2021.

within the international scientific community but also in business and the general public.

1.3 Why does the UoC need Open Science Principles?

The full potential of Open Science can only be realized when this approach becomes an integral part of research practices worldwide. As a first step, the University of Cologne aims to create **awareness** for this topic by adopting its own **Open Science Principles. They are intended to clearly define core aspects of Open Science, to set priorities as well as to describe current framework conditions and give specific recommendations**. To this end these principles serve as guidelines on how selected Open Science practices can be integrated into research and teaching at UoC. Through **regularly scheduled updates,** these principles might as well be extended to cover **further aspects of Open Science** (e.g. →Open Peer Review, →Open Innovation, →Citizen Science).

1.4 Whom are the Open Science Principles aimed at?

These Open Science principles are addressed to all members of the university who conduct or support research and/or teaching. The University of Cologne strongly recommends implementing the principles outlined here. **Specific requirements** and restrictive conditions of **different academic disciplines will be considered.**

Deviations from the recommended Open Science practices may occur under the following circumstances: legal restrictions (such as data protection, licenses, usage and exploitation rights), ethical and security-related concerns, technical and financial limitations, as well as commercial interests (e.g., patents, spin-offs, etc.). Consequently, third-party rights to research results, policies of the preferred publication media[6], potential re-use scenarios, and the compatibility with knowledge and technology transfer should be taken into consideration early on in Open Science concepts[7].

The UoC expects responsible handling of such restrictive conditions and recommends a critical analysis of how research practices can be further developed towards Open Science prospectively.

[6] For example, it is advisable to review the policy of the respective journal regarding its stance on pre-publication (→Preprint).

[7] Patent and Utilization Guidelines (2023) https://verwaltung.uni-koeln.de/forschungsmanagement/content/e144583/e62787/20240215_UzK_IPGuideline_short_final_eng.pdf
Researchers are advised to seek early consultation with the Department 75 Transfer regarding possible exploitation options before publication.

2. RECOMMENDED ACTIONS FOR UOC MEMBERS AND THE UNIVERSITY ITSELF

The UoC recommends that **academic achievements**, such as publications, research data, code, or educational resources, be made publicly accessible as open as possible.

The UoC **expects its members to apply for funding to cover costs of Open Science practices** if such resources are provided by funders. The UoC also **expects** its **researchers** to **create and maintain an Open Researcher and Contributor Identity (ORCID)** and to **indicate** it in significant scientific activities, ensuring the clear attribution of the research achievements of UoC researchers[8].

2.1 Open Research Process

Providing public access to the research process not only increases its transparency and credibility, it can also significantly improve the effectiveness and quality of subsequent processes.

Therefore, UoC recommends **openness in all phases** of a research project. In some disciplines, practices such as preregistration (→Preregistration), publication and peer review of the research question and methodology (→Registered Reports), and prepublication (→Preprint) have already been established. UoC also encourages the **publication of null results** and the recognition of such research contributions as they significantly contribute to the state of research.

The cultural shift towards Open Science also requires an open approach to errors in research and teaching processes, which are always a part of human action and learning. Therefore, **UoC encourages** its members to adopt a **transparent and tolerant culture towards mistakes**[9] and to move away from blame culture.

2.2 Open Access to Scholarly Publications

Scholarly publications are considered open (**Open Access, OA**) when they are freely accessible and reusable over the Internet without any cost or restrictions for the reader. Open Access publications still adhere to copyright laws, but reuse should be governed by attribution of clearly defined and preferably →Open Licences (e.g. Creative Commons licenses[10]).

There are different roads to Open Access Publishing: **Gold Open Access** refers to the immediate publication over the internet, while the so-called **green route** refers to the self-archiving of publications in OA repositories that were previously published through other publication venues. **Diamond Open Access** refers to immediate and free publication without charging any fees to either authors or readers. The costs in this case are borne by scientific societies or other academic institutions.[11]

UoC recommends that its members **publish all research results Open Access**, provided that it does not result in any disadvantages for them or for the UoC.

When choosing a publication venue, it is essential to consider its credibility in order to avoid promoting so-called "predatory publishing," which involves fraudulent publishing practices without appropriate quality control.[12]

[8] Further information and a guide can be found on the pages of the USB Cologne: https://ub.uni-koeln.de/en/research-publishing

[9] Approaches to developing such a culture of dealing with errors are addressed by a working group of the NFDI (National Research Data Infrastructure) section EduTrain: Herres-Pawlis, Sonja et al. (2022). NFDI_Section_EduTrain_Working_Group_Charter_Error_Management_and_No_Blame_Culture_V1_0 (1.0). Zenodo. https://doi.org/10.5281/zenodo.6475492

[10] Creative Commons: https://creativecommons.org/ (Last checked: 04.08.2023)

[11] See Depping, R Open Science and Open Access im Aufwind. Working Paper. Cologne: Universitäts- und Stadtbibliothek, 2022. https://kups.ub.uni-koeln.de/55535/ (last checked: 04.08.2023)

[12] The German Research Foundation (Deutsche Forschungsgemeinschaft) DFG Position Paper on Academic Publishing as a Foundation and Area of Leverage for Research Assessment. Bonn, 2022, p.27. https://www.dfg.de/download/pdf/foerderung/grundlagen_dfg_foerderung/publikationswesen/positionspapier_publikationswesen_en.pdf (last checked: 04.08.2023)

The University and City Library of Cologne (USB) offers comprehensive publication support and provides advice on matters related to scholarly publishing and Open Access.[13] For a current list of high-quality and peer-reviewed Open Access journals, the Directory of Open Access Journals (DOAJ)[14] is a valuable resource.

UoC supports Open Access Publication structurally, such as through the operation of repositories and Open Access journals, as well as with financial and administrative resources. The electronic publication of scientific publications can be done through the university repository and should be documented in the research bibliography within the →Research Information System (RIS).

Additionally, UoC **recommends** that researchers make their submitted manuscripts (→Preprints) available on recognized preprint servers according to disciplinary conventions.

2.3 FAIR and Open Data

→Open Data refers to the access to research data for the purpose of verifying research results and the resource-efficient reuse of existing datasets. The handling, documentation, and provision of research data depend on the **type of data, the culture within individual disciplinary fields[15], and the availability of sustainable infrastructures**.

UoC adopts the principle of the European Commission "as open as possible, as closed as necessary"[16] and aligns itself with the →Guidelines for Good Scientific Practice (GWP) of UoC to facilitate public access to research results[17].

Accordingly, UoC advises researchers to handle, document, and archive **research data** following the →FAIR Principles[18] – **F**indable, **A**ccessible, **I**nteroperable, and **R**eusable – and to provide clear and citable metadata through a suitable (subject-specific) data repository. With the Cologne Competence Center for Research Data Management (C³RDM) the UoC **offers a central service infrastructure for research data management (RDM) support** along the data lifecycle[19]. Furthermore, UoC **expects** researchers to actively use existing, high-quality research data from trustworthy repositories for sustainability purposes[20].

[13] See USB Cologne: Open Access auf einen Blick. https://ub.uni-koeln.de/en/forschen-publizieren/publizieren/publishing-open-access (last checked: 04.08.2023)

[14] DOAJ (Directory of Open Access Journals): https://doaj.org/about/ last checked: 04.08.2023)

[15] The German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) provides a regularly updated overview of discipline-specific recommendations for handling research data: https://www.dfg.de/en/research_funding/principles_dfg_funding/research_data/recommendations/index.html (last checked: 04.08.2023)

[16] European Commission: A European strategy for data. Brussels, 2020. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0066 (last checked: 04.08.2023)

[17] Guidelines for Good Scientific Practice of UoC: https://portal.uni-koeln.de/en/research/scientific-integrity/safeguarding-good-scientific-practice Also see: Deutsche Forschungsgemeinschaft. (2022). Guidelines for Safeguarding Good Research Practice. Code of Conduct. https://doi.org/10.5281/zenodo.6472827 (last checked: 21.12.2023)

[18] See GO FAIR: https://www.go-fair.org/fair-principles/ (last checked: 04.08.2023)

[19] C³RDM is a central operational unit of the university and offers individual research data management consultations, training, e-learning, a service catalogue for technical infrastructure, and networking activities, among other services. https://fdm.uni-koeln.de/en/home (last checked: 21.12.2023)

[20] When searching for suitable data repositories, the DFG-funded search portal re3data.org can be helpful. https://doi.org/10.17616/R3D (last checked: 04.08.2023)

2.4 Open Code and Software

For the preservation of research outcomes, it is beneficial to avoid proprietary **data formats** in the interest of interoperability and long-term accessibility. There is no issue with using proprietary software as long as the results can be **archived in open file formats** or converted with minimal loss. UoC **recommends using open-source software** if it is available in a high-quality and secure form.

When **developing** computer codes or software, openness (**Open Code/Open Source**) enables further utilization and encourages collaboration among users. If codes (e.g. data analysis scripts, experiment control scripts) and/or software components are part of the research process and research output, their publication is essential for reproducibility and also serves as an incentive for subsequent use and potential collaborative development. UoC **advises researchers to share and publish their scripts and software under suitable Open Source licenses whenever possible**. Prior advice[21] should be sought on issues related to intellectual property, transfer, licensing, and third-party rights.

2.5 Open Educational Resources

According to UNESCO, **Open Educational Resources (OER) are learning, teaching, and research materials that are either** in the →public domain or released under an →open licence, allowing for free access, reuse, adaptation and redistribution by others[22].

OER play a significant role in promoting inclusive, equitable, and high-quality education, while also enhancing opportunities for lifelong learning. Open Educational Resources can be quickly and efficiently adapted to meet the needs of learners and various learning environments. OERs can be utilized to contribute to a collaborative development of teaching and learning materials.

UoC supports the use and creation of OER in teaching and emphasizes that when using public domain or open licenses, it is necessary to analyse and consider the intellectual property rights of all creators involved in OER resources by establishing appropriate agreements for further use of teaching, learning resources and research materials.

The UoC is co-operator of the state-funded OER portal ORCA.nrw (Open Resources Campus NRW) and provides advisory services for OER. Teachers are **recommended to stay informed** about these services.

2.6 Support Services for Open Science Practices

Researchers and staff require specific competencies to implement the aforementioned practices. Further education offers are essential to establish Open Science as a norm.

UoC promotes and finances trainings[23] **in the field of Open Science for all academic career stages**. These offers will continuously be expanded and further developed in the coming years. UoC **recommends** to actively make use of the **provided training opportunities and to engage in regular professional development.**

[21] Information on licensing, reuse and utilization strategies are bundled on the central OSCC Website and linked to consultation offers by different UoC departments Dep. 75 Transfer, C³RDM, OER advisory services).

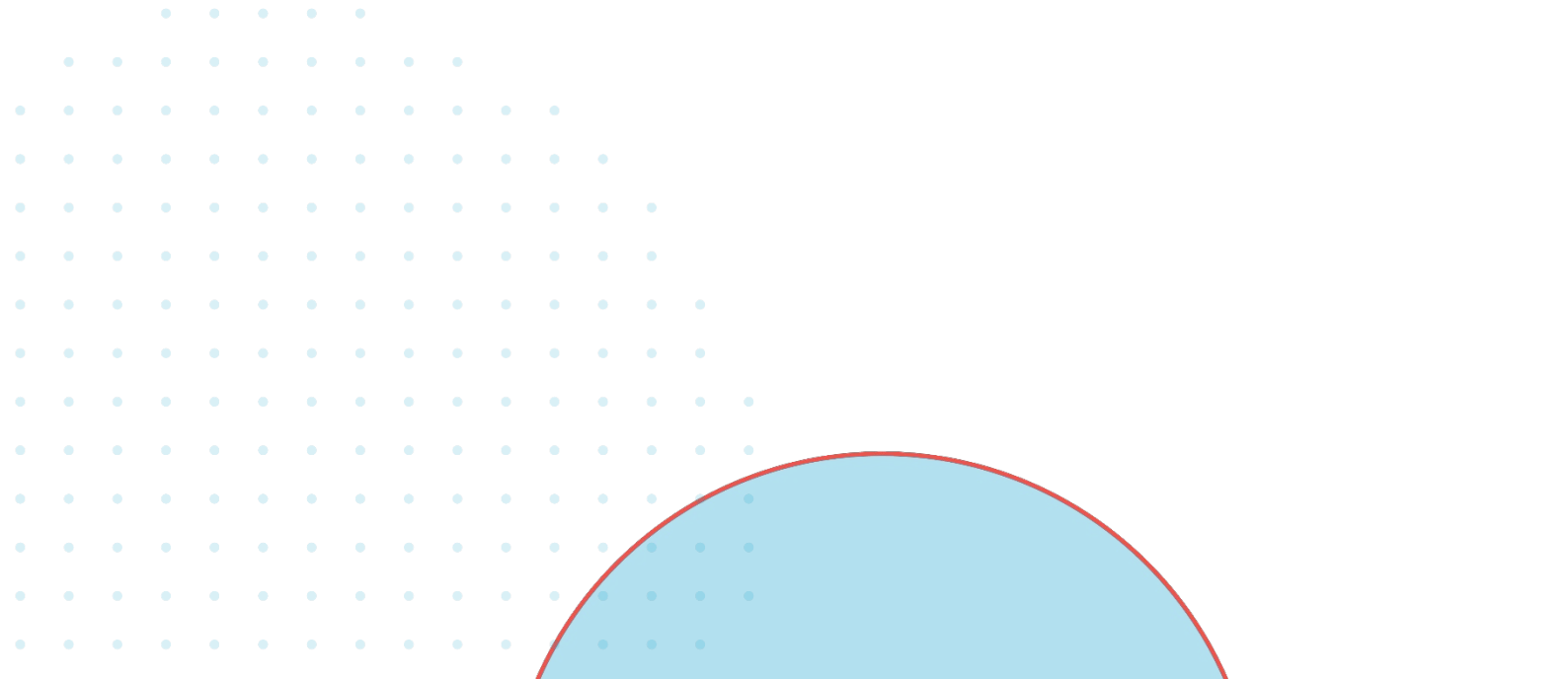
[22] Unesco: Recommendations on Open Educational Ressources.2024 https://www.unesco.org/en/legal-affairs/recommendation-open-educational-resources-oer

[23] Existing training offers will soon be linked on the OSCC website. https://oscc.uni-koeln.de/en/open-science-center-cologne https://ub.uni-koeln.de/en/courses-consultations/courses-by-the-ucl

3. IMPLEMENTATION OF THE OPEN SCIENCE PRINCIPLES

To implement these principles, the UoC needs to develop information events and awareness measures, analyse and expand training and further education offers in a targeted manner as well as update relevant guidelines. The iterative development of the Open Science principles will consider national and international activities in this transformative process.

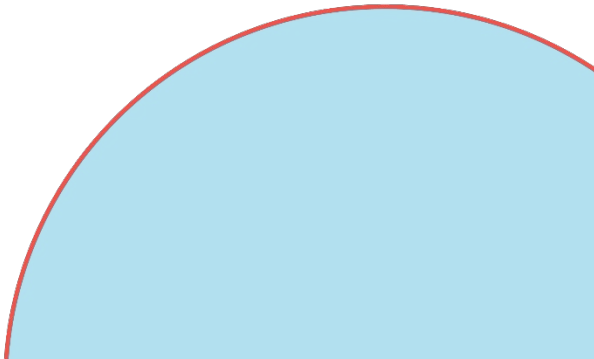
Based on a separate **implementation plan** progress will be regularly **evaluated** and coordinated by the Vice-Rectorate for Research. A revision of the principles will take place at least every three years, with broad involvement from university members.



ABSTRACT

General	UoC recommends that **scientific achievements**, such as publications, research data, code, or teaching and learning materials, be made publicly accessible as open as possible.
	UoC expects researchers to apply for **Open Science resources** when they are made available by funding bodies.
	UoC also expects its members to create and maintain an Open Researcher and Contributor Identity (ORCID) and to include it in significant scientific activities, ensuring clear attribution of the research contributions of UoC researchers.
Open Research Access	The UoC recommends **openness in all phases of a research project**.
	The UoC also encourages the publication of null results and the recognition of such research.
	Therefore, UoC encourages its members to adopt a transparent and tolerant culture regarding errors and to avoid a culture of blame.
Open Access	UoC recommends its members to publish all scientific achievements as Open Access, as long as it does not cause any disadvantages for them or the university
	UoC recommends that researchers make their submitted manuscripts available on recognized preprint servers in accordance with disciplinary practice.
	UoC supports Open Access structurally (e.g. by operating repositories and Open Access journals) and with financial and administrative resources.
FAIR and Open Data	UoC adopts the principle of the European Commission, "as open as possible, as closed as necessary," and aligns with the Guidelines for Good Scientific Practice (GSP) of UoC for achieving public access to research results.
	UoC recommends, for the sake of sustainability, the active utilization of existing, high-quality research data from trustworthy repositories.

Open Computer Programs	UoC recommends the **use of open-source software** when it is available in high-quality and secure form.
	Proprietary data formats should be avoided in the interest of interoperability and long-term availability.
	UoC **advises its researchers** to **provide their developed scripts and programs under suitable open-source licenses** whenever possible.
Open Teaching and Learning Materials	UoC **supports the use and creation of Open Educational Resources (OER)** by its educators and emphasizes that even when using public domain or open licenses, it is necessary to analyze the rights of the involved authors and make appropriate agreements for the further use of learning, teaching, and research materials.
	The **University is a co-operator** of the state-funded OER portal ORCA.nrw (Open Resources Campus NRW) and offers advisory services on OER. **Educators are recommended to regularly inform themselves about these offerings**.
Support Services for Open Science Practices	The **UoC** promotes and finances training opportunities in the field of Open Science for all academic career stages.
	UoC **recommends** that its researchers **actively participate in the offered training opportunities** and regularly update their skills.



GLOSSARY

Citizen Science	"Citizen science describes the engagement of people in scientific processes who are not tied to institutions in that field of science. Participation can range from the short-term collection of data to the intensive use of leisure time in order to delve deeper into a research topic together with scientists and/or other volunteers. Although many volunteer scientists do have a university degree, this is not a prerequisite for participating in research projects. However, it is important that scientific standards are adhered to. This pertains especially to transparency regarding the data collection methodology and the open discussion of the results."[24]
Research Information System	The Research Information System (RIS) serves as a digital reporting system for research activities. Following a nationally standardized data format, the current status of research activities and achievements of all researchers at the UoC is continuously maintained and made visible. See also: https://ris.uni-koeln.de/en/
Public Domain	Works that are not protected by copyright are considered "public domain". This can be because the copyright protection term has expired or the work does not meet the required level of creativity for copyright protection. By applying a "Creative Commons Zero" (CC0) license, even copyrighted works can be made available for use without any additional conditions. See also: https://irights-info.translate.goog/artikel/gemeinfreiheit-wie-frei-ist-frei/29619?_x_tr_sl=de&_x_tr_tl=en&_x_tr_hl=en
FAIR Principles	Principles for the sustainable handling of research data, which should be permanently findable, accessible, interoperable, and reusable.
Metadata	Structured and ideally standardized data that contain information about characteristics of other data (administrative, descriptive, or technical metadata).
Open Licenses	Open licenses allow extensive reuse of works of all kinds. In the Creative Commons model, the licenses CC0, CC BY, and CC BY-SA are examples of such licenses. See also: https://opensource.org/license

[24] Green Paper. Citizen Science Strategy 2020 for Germany, p. 13: https://www.buergerschaffenwissen.de/sites/default/files/assets/dokumente/gewiss_cs_strategy_englisch.pdf

Open Innovation	Open Innovation promotes the strategic opening and cooperation of science and business through knowledge and technology transfer based on a business model implementing intellectual property.
Open Peer Review	In order to address the criticism of the process of quality assurance of scientific publications through peer review (double-blind review) and to make the process more transparent, models for open, online review and open handling of the identity of the reviewers were developed.
Preregistration	Even before data analysis begins, the research plan for a scientific study (research questions, hypotheses, research design, variables, etc.) is written up and published on appropriate platforms (e.g., Open Science Framework).
Preprint	The pre-publication of a research report prior to the review process of a journal or publisher in order to accelerate scientific communication is now also advocated by major publishers. However, it is advisable to carefully check the respective publisher policies.
Registered Report	Even before data collection, the research question and planned methodology are published and subjected to a peer review process. This honors best practices and eliminates questionable research methods[25]. For a database of journals that accept these reports, see: https://www.cos.io/initiatives/registered-reports
Repository	Trusted, digital (long-term) archive and, where appropriate, open access publication outlet for research results and/or research data.

[25] See: Center for Open Science (COS): Registered Reports. https://www.cos.io/initiatives/registered-reports (last checked 04.08.2023)

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