CONCORDIA OPEN SCIENCE WORKING GROUP

RECOMMENDATIONS FOR FOSTERING OPEN SCIENCE AT CONCORDIA UNIVERSITY

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Background

[Open science](#)—and open scholarship more broadly—is revolutionizing how research is conducted by democratizing access to knowledge and bringing inclusion and transparency to the forefront. By making research processes and products open and accessible to all, open science promotes fairness, efficiency, and accountability in the scholarly enterprise and ensures that the benefits of scientific and humanistic progress are shared with all segments of society.

In Canada, fostering the practical implementation of open science practices (e.g., [open access](#), [open educational resources](#), [open data](#), [open labs](#), [open notebooks](#), [open evaluation](#), [open hardware](#), [open-source software](#), and [citizen science](#)) is rapidly becoming a top priority. The [Government of Canada's Roadmap for Open Science](#) envisions a complete transition to an "open by design and by default" model by 2025. This transition is underway, with policies being promoted by federal and provincial funding agencies. For example, the federal funding agencies, also known as the Tri-Council, have enacted an open-access policy requiring grant recipients to ensure that publications funded by the agencies are freely accessible within 12 months of publication. This can be achieved by depositing peer-reviewed manuscripts in institutional or disciplinary repositories or publishing them in open-access journals. Departing from the Tri-Agency model and aligning with [Plan S](#), the Fonds de Recherche du Québec (FRQ) updated its [Open-Access Policy in 2022](#), requiring that articles and theses be made freely available under an open license upon publication or institutional deposit. The fast-approaching date of 2025, in combination with new mandates and policies, will require institutional support and advocacy to achieve effective solutions.

On May 27, 2022, Concordia University took a decisive step towards advancing open science by hosting the [Open Science @Concordia conference](#), which brought together a diverse group of open science advocates and stakeholders from Concordia University and other institutions. The conference included keynote talks by national and international speakers, interdisciplinary lightning-talk sessions, and roundtables. Ten national and international speakers presented on topics like open access, open data, [open infrastructures](#), open educational resources, and citizen science. Jessica Polka ([ASAPbio](#), USA) delivered a powerful keynote on the pressures of publishing with preprints, and Malvika Sharan ([The Turing Way](#), UK) presented on fostering open communities.

Building upon the momentum generated from the conference, we established the Concordia Open Science Working Group, whose first workshop was held on September 30, 2022. During this half-day session, more than 20 faculty members, trainees, and students from 8 different academic units, including Psychology, Computer Science and Software Engineering, Chemistry and Biochemistry, Biology, Mechanical, Industrial, and Aerospace Engineering, Education, Communication Studies, and the Library, gathered at the Loyola Campus to explore the challenges and possibilities of promoting open science at Concordia. This report presents the key insights derived from this workshop, as well as a comprehensive examination of the methodologies used and a full account of the results (see Appendix).

Key Findings

Institutional Responsibility for Open Science at Concordia University

On an institutional level, Concordia is a founding member of the Coalition of Open Access Policy Institutions (COAPI), a group of North American universities and colleges with established faculty open-access policies. Further, the university has a 2010 senate resolution on open access (the first in Canada), pockets of researchers who embrace open science initiatives, and a Library committed to fostering open scholarship and education. The university also signed the Berlin Declaration on Open Access to Knowledge in 2011. Despite these positive first steps, open science is still in its infancy at Concordia University, and a comprehensive open science community has yet to be established.

There are many researchers knowledgeable in open science at Concordia who can play a crucial role in fostering such a community and driving change in the institution. For example, Dr. Krista Byers-Heinlein, a professor in the Psychology department, holds the Concordia University Research Chair in Bilingualism and Open Science, and Dr. Nicolás Alessandroni, a Concordia Horizon Postdoctoral Fellow, specializes in open science practice in infant research. These positions have allowed Drs. Byers-Heinlein and Alessandroni to start paving the way towards building an open science community by hosting the Open Science @Concordia conference and founding the Open Science Working Group.

Pockets of researchers are already prioritizing open science in their workflows and in the dissemination of their work. For example, Explore Concordia has at least 12 keywords related to essential open science interests. Users have selected these for their profiles at least 37 times. Concordia's researchers have long contributed to the Spectrum Research Repository with 19,316 deposits to date, resulting in worldwide open access to research. Faculty deposits receiving more than 1,000 downloads in 2022 alone include research contributions from several Concordia faculty members[1]. Meanwhile, faculty members have developed open textbook projects for use in their classrooms, directly benefiting students[2]. Additional open educational projects will be launched in 2023 onwards.

Similarly, the Concordia University Library already promotes and fosters open science practices, including resources for open-access publishing, open licensing, open data, and open educational resources. Additionally, the Library offers workshops and events, including programming for Open Access Week in the fall and Open Education Week in the spring. For example, Concordia University's event Open for Climate Justice (October 25, 2022) brought together the otherwise disconnected open science research and education projects occurring across disciplines. Another example is the librarian-supported and student-led event OER Discovery Minute (April 4, 2023), a drop-in information session about open-access resources (e.g., OERs) for students that received 160 (mainly undergraduate) student participants.

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[1] Including Drs. Jason Edward Lewis (Design and Computation Arts), Bipin C. Desay (Computer Science and Software Engineering), Michel Laroche (Marketing), Andrew G. Ryder (Psychology), Raul Valverde (Supply Chain and Business Technology Management), Reilly Rosemary (Applied Human Sciences), and Krista Byers-Heinlein (Psychology).
[2] Developers include Drs. Pierre-Yann Dolbec (Marketing), Brian C. Vermeire (Mechanical, Industrial and Aerospace Engineering), Erin Barker (Psychology), Leslie Barker (Health, Kinesiology and Applied Physiology), and Lucia Farisello (Psychology).

Beyond events and workshops, the Library hosts open educational resources (OERs) service grants for open textbooks and an institutional EPrints repository, Spectrum, which fosters access to theses, preprints, and postprints, and contributes to Article Process Charge (APC) discounts for Concordia authors. The Library also provides access to Borealis, a Canadian-based repository for hosting small-to-medium-sized open datasets. At the same time, Concordia University Press, housed within the Library, is a university publisher for open-access peer-reviewed books with an expressed interest in several subject areas including the history of science and technology, the history of medicine, and media and communications.

Concordia has committed to advancing the United Nations Sustainable Development Goals (SDG) and the University's own Sustainability Action Plan, both of which are concerned with research and education. For instance, the focus of SDG 4 is to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Open science or open scholarship is fundamental to this goal. It makes participation in research processes more attainable to people normally excluded due to issues such as access and funding. The inherent preference for open-source software and open-access publishing further supports learning beyond the university.

Equity, Diversity, and Inclusion (EDI) are also central to open science. Concordia's agenda on promoting EDI has advanced during the last few years thanks to different initiatives. The provost put in place the Working Group on EDI in 2018 to build a framework for a coordinated EDI strategy across the university, generating reports that include fundamental guiding principles and recommendations. This resulted in different initiatives such as the creation of the Standing Committee on EDI as well as other training programs, departmental committees, and discussion groups.

Together, these important actions and individual contributions have played an essential role in paving the way toward building an open science community at Concordia. However, lasting change will require clear incentives for researchers and buy-in from departmental and other academic units. Additionally, the current hiring, tenure, and promotion policies neglect the significance of open science practices, which may create reluctance among researchers to engage in open science. This lack of recognition, combined with the university's limited investment in open science training and related personnel and resources, hinders the widespread adoption of open science at the institution.

It is time for Concordia University to step up, set an example, and take ownership of its open science future by acting on its previous commitment to "take a leadership role in Canada and exemplify social responsibility by supporting the principles of open access" (senate resolution, 2010). Open science aligns perfectly with Concordia's mission of experiential learning and being a next-generation institution. Given its pioneering position, Concordia is poised to become a leading example, demonstrating how Canadian universities can foster and implement open science.

Recommendations for Bolstering an Open Science Community

Concordia should:

- Broaden the [university's senate resolution on open access](link) (dated to 2010) and update it to reflect the current state of open science and the need for widespread departmental and researcher buy-in.
- Continue to support foundational initiatives, like the [Open Science @Concordia conference](link) (inaugurally held in May 2022) and the Concordia Open Science Working Group led by Drs. Byers-Heinlein and Alessandroni, alongside library-hosted Open Access Week and Open Education Week events and services, which are crucial milestones along this pathway. These are key to creating awareness of the benefits of adopting open science practices, both broadly and in discipline-specific ways.
- Further the development of copyright support through an institutionally supported rights retention strategy, which can support [green open access](link) and diversify how research can be made openly accessible.
- Promote public outreach by creating (and enhancing existing) training programs in popular science writing for faculty and students using local expertise from the Department of Journalism, the Department of Communication Studies, and the Library.
- Strengthen ties with other institutions and organizations to secure long-term funding and resources for the implementation of open science.
- Position principles of equity, diversity, and inclusion at the core of open science practices, including designing, generating, and publishing science.
- Promote open education at Concordia, for example by highlighting in course calendars which courses use open materials, open software, and renewable assignments.

Recommendations for Allocating Resources to Promote a Culture of Open Science

- Concordia can send a strong message about its commitment to open science by incorporating open efforts into the decision-making process for hiring, tenure, and promotion and by recognizing researchers who embrace open science practices through funding or reduced workloads. For example, professors who develop open textbooks could receive a teaching release during their development.
- The university must develop strategies to acquire and retain staff with the knowledge and ability to drive change, such as postdoctoral fellows and researchers knowledgeable in open practices.
- The university should create specific research positions in open science, such as through a cluster hire and through postdoctoral positions that emphasize open science.
- Establishing an Open Science Observatory or an Office of Open Science (similar to the Office of Indigenous Directions or the Black Perspectives Office) can help monitor progress and promote a culture of openness, which includes the de-siloing of

open work being done across disciplines within STEM fields, humanities, and fine arts.
- Given the Library's early leadership on open access, it is important to ensure that the Library is adequately supported in terms of librarian and support-staff positions dedicated to scholarly communication, digital research techniques, and open data.
- Concordia University hosts a great wealth of ongoing initiatives that work according to open science practices (see Appendix - Strengths). More resources (i.e., funding and space) should be allocated since many of these initiatives are sustained through per-cycle funding competition and therefore not guaranteed. For example, funding support and operational support are needed for the open-access publishing program at Concordia University Press as well as open-access publishing in general.

Adopting Open Science and Open Scholarship Across Disciplines at Concordia

Open science is a rapidly growing approach that has the potential to transform the way research is conducted at Concordia University across disciplines. The term, however, suggests that the practice applies only to scientific disciplines. Moving forward, we propose that, in conjunction with continued discussions of open science, use of the term "open scholarship" would provide an inclusive option that speaks to non-scientific scholarly fields as well as the ecosystem between scholarship and higher education.

Implementation of open science and open scholarship will vary significantly across disciplines. For example, computer science researchers are familiar with the open-source software movement and its tradition of sharing knowledge and skills. In contrast, researchers in other fields have different needs and levels of exposure to open practices, which translates into discipline-specific obstacles and constraints in implementing open science practices. The differences—that have yet to be comprehensively assessed—present significant challenges to the widespread adoption of open science at Concordia. Other issues requiring particular attention include the handling of sensitive data, the integration of open science with disciplinary norms, and the ability to study, reproduce, reuse, and preserve research data and software source code and digital files. An additional issue is the significant funds the university spends on expensive licenses for proprietary software that students will not be able to use after their studies.

Relatedly, although students at all levels show interest in open science, they do not actively participate in open science advocacy efforts, possibly due to a lack of empowerment or a dearth of training opportunities. Another challenge is that students and trainees who are strong open science advocates are not retained by the institution and leave Concordia after their studies or temporary contracts.

Recommendations to Foster Interdisciplinarity in the Adoption of Open Science and Open Scholarship Practices Across the Institution

- To meet these challenges, it is critical for Concordia to convey that an open scholarship culture benefits all disciplines, not only the sciences.

- There is no one-size-fits-all definition of open science. Researchers in different disciplines should be encouraged to define and implement open science practices according to their specific needs and concerns.
- Faculty members across departments should be incentivized to adopt open-source software and incorporate open science into their curriculum to give students hands-on experience. The university should also consider transitioning to open-source software and materials to improve reproducibility, enhance learning, innovate digital research techniques, and support the preservation of the research record. This will also reduce costs while fostering the creation of shared guidelines for using open-source software. While we recognize that this point generates some tension with the university's security concerns and mandates, we recommend that Instructional and Information Technology Services (IITS) be encouraged to gain further experience in open-source software and work closely with the university to harmonize security with openness.

The adoption of open scholarship and open science at Concordia University will require a concerted effort from all stakeholders, including the administration, faculty, students, and support services. These invested efforts can create an environment that supports and values open science, ultimately benefiting all members of the Concordia community, regardless of their discipline.

Potential Challenges

Implementing open science entails a cultural and behavioral shift necessitating significant time, effort, and tangible resources. Despite increased mandates from granting agencies and a growing interest among early career researchers, some researchers—particularly more senior researchers with established knowledge and workflows—may still have reservations about adopting open science practices. This could be due to various fears and concerns associated with open science practices. For example, researchers may fear being scooped when publishing open data, have concerns about sharing sensitive data, and be uncomfortable sharing preprints before journal publication. Similarly, they may perceive open science as hindering commercial research and see pre-registration practices as limiting research flexibility and data analysis possibilities.

Additionally, researchers in fields outside of the sciences in particular, such as the humanities and arts, may have questions about what, why, and how to share openly. Those conducting research with human participants may have unique concerns about data anonymity. As another example, some IT professionals may be hesitant to widely adopt open-source software due to fears related to safety and data security. Importantly, the lack of training in open science at Concordia results in open science implementation being a personal decision rather than an institutional commitment. Furthermore, trainees may be prone to adopt open science practices, though their involvement may be limited if their supervisors disagree with open practices.

Finally, some open science practices may not be feasible or straightforward to implement in some contexts. For example, commercial research may have limitations on sharing due to

intellectual property or contractual agreements. Further, research by and with Indigenous communities should conform to principles of ownership, control, access, and possession (OCAP), such that communities themselves decide the degree of openness appropriate for their data. More generally, values of openness must be considered in the context of other core values such as the ethical conduct of research.

Recommendations for Overcoming Potential Implementation Challenges

- Highlight successful examples of open science implementation both within Concordia and at other institutions.
- Contact academic units to designate an ambassador liaison (faculty, staff, and/or trainees) who can advocate for open science, promote open science leaders and mentors across departments and career levels, facilitate access to information, provide open science news, and provide quick and efficient support for researchers with questions or concerns related to open science.
- When working with diverse stakeholders or in contexts where openness is more challenging, initiate discussions early and often to explore potential strategies.

Conclusions

At Concordia University, the implementation of open science is nascent. This opens many avenues for advancing current practices. However, readiness for sustainable change requires amplifying the appetite for open science first. To achieve that, we need to continue to develop opportunities to broaden the dialogue and raise awareness of the advantages of open science for scientific research across disciplines. We also need to discuss with researchers science policy in the national and local contexts, and the changes to everyday workflows that will be brought about by the open science mandates that different institutions are beginning to enforce.

Crucially, we need to continue to develop an open science community, a task that has already begun with the establishment of the Open Science Working Group and can be scaled up with the support of all university stakeholders. For example, librarians and library staff have historically provided, and continue to provide, invaluable support and training because they are knowledgeable in many aspects of open science and the resources needed to support students and fellow faculty members. GradProSkills can continue to offer training on open science and expand its offerings. Departments and the administration must also get involved in this process by developing concrete policies to foster open science, including, but not limited to, increased financial support for open science activities and changes in institutional mechanisms (e.g., evaluation of research activity).

This report includes specific recommendations that can be consulted in the design of new institutional policies (see Appendix for additional recommendations). Beyond the university administration, all of us at Concordia are responsible for driving change toward an open

culture and can take action today. This report has identified a number of concrete steps that can be taken immediately.

Glossary of Open Science Terms

- ***Open science***: The practice of science so that all research processes and outcomes are available and accessible to all people without barriers. Open science is a broad concept encompassing multiple practices, including open access, open data, open labs, open notebooks, open evaluation, open hardware, open-source software, and citizen science, among others. Importantly, the term "science" in this context includes the humanities, social sciences, business studies, and fine arts.

- ***Open access***: The dissemination of research outputs through the Internet without any access fees and with minimal limitations. Depending on the selected open-access route (e.g., green, gold, diamond), there may or may not be costs involved for the researchers or their institutions.

- ***Open data***: The practice of making data freely available and accessible so that it can be used, reused, and redistributed by anyone without any restrictions or limitations, provided authorship is acknowledged, and privacy is respected when needed (e.g., not divulging people's identity in psychological/medical research).

- ***Open educational resources***: Learning materials in any format and medium with a copyright license that allows anyone to use them freely according to the 5Rs defined by David Wiley: retain, resume, revise, remix, and redistribute.

- ***Open labs***: The act of making laboratory methods, data, and results openly available to the public, other researchers, and stakeholders.

- ***Open notebooks***: A way of documenting and sharing research data and findings in real-time as they are generated. Open notebooks can be used to reproduce the research results and to support the transparency and reproducibility of the findings.

- ***Open evaluation***: The process of evaluating and providing feedback on scientific research that is transparent, inclusive, and collaborative. In open peer review, the identities of the reviewers and authors are known to each other, and the review process is usually made publicly available along with the final publication.

- ***Open hardware***: The practice of using scientific equipment, instruments, and devices that are designed and built to be openly accessible, modifiable, and distributable by anyone.

- ***Open infrastructure***: The practice of openly distributing the configurations in a code repository. This allows users to freely use, study, and redistribute original or modified copies.

- ***Free and open-source software***: Often simply called open-source. This software provides people the freedom to study, modify, use, and distribute its source code with few restrictions or limitations. Its source code is made publicly available and typically maintained by a community of volunteer developers, educational or research institutions, commercial enterprises, non-profit organizations, and other users contributing to its development and improvement. Open-source software, frequently at the forefront of innovation, has become increasingly popular due to its flexibility, affordability, and transparency.

- ***Citizen science***: An approach to scientific discovery that involves non-professional or amateur scientists, or "citizens," in various aspects of the scientific process. This may include defining research questions, applying for funding, observing phenomena, collecting data, or contributing to data analysis and dissemination of results, often via online platforms. By leveraging the collective efforts of many individuals, citizen science can help to advance scientific discovery and promote public engagement in science.

- ***Open licenses***: Agreements granting permission to use, modify, and distribute scientific research outputs such as data and publications with few restrictions. Open licenses promote the sharing and reuse of scientific knowledge. [Creative Commons copyright licenses](#) are a common type of open license used in scientific publishing.

- ***Preprints***: Scientific manuscripts that authors upload to open repositories such as [PsyArXiv](#) or [Zenodo](#) before submitting them to a journal or while they are being evaluated for publication. By doing so, the manuscripts become available and accessible to everyone.

- ***Pre-registration***: A time-stamped and immutable research plan that researchers write before conducting a study and deposit in an open repository for free access by others. This plan typically includes the study details (i.e., research question, objectives, hypothesis, data collection procedures, variables considered, etc.) and an analysis plan (i.e., confirmatory and exploratory data analyses that will be performed, inference criteria, etc.). Pre-registration enhances the transparency and rigor of research by promoting a priori planning and reducing selective reporting of results.