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Open Science Guiding Principles

Western Institute for Neuroscience

Unlocking human knowledge through open science isn't just a revolution, it's an evolution that empowers collaboration, accelerates discovery, and paves the way for a brighter, more informed future.

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Open Science Philosophy

Open science endeavours to make scientific research and its dissemination accessible to all stakeholders. It strives to increase the rigour, accountability, and reproducibility of research by making scientific inputs, outputs and processes freely available to all with minimal restrictions.

Scientific research, particularly in the field of neuroscience, is becoming more globally connected, driven by access to primary research data, and dependent on computing. This combination of evolutions in research has led to a growing consensus among researchers, institutes and funding agencies that adopting open science is essential to realize the full potential of our research goals. By endeavouring to make every step of the research process publicly accessible with minimal restrictions—including the experimental plan, methodology for acquisition and analysis, and the full raw data—we enable reproducibility and refinement by other scientists as well as rapid translation from discovery to innovation.

A key way open science increases the efficiency of discovery while maintaining research quality and integrity is by promoting the reproducibility of scientific results. When supported by an institutional framework, research conducted on an open science platform allows more researchers to access resources for novel use and/or verification, while encouraging opportunities for domestic and global participation in the research process. Furthermore, when discoveries and the inputs and outputs of research are openly shared, it enables others to rapidly build upon those discoveries, enabling a swifter path from research to innovation.

Beyond the scientific benefits of open science, embracing this philosophy promotes economic and societal benefits by making research from publicly funded institutions available to the whole of society; enabling the most efficient use of research and building confidence in the investment society makes through supporting research. Furthermore, open accessibility of research is a necessary first step in enabling the public to actively participate in meaningful discourse about the importance of research and in helping the public to take an active role in research itself. Perhaps an even more vital aspect of ensuring the general public has access to our research products in an approachable and digestible form is that it allows increased awareness and conscious choices. In a society where knowledge and information are valuable resources, open science plays a key role in promoting knowledge economies.

Commitment to Open Science

WIN endeavours to be Western University's open science-focused institute with the principles of open science guiding its governance, decision-making and identity. As such, open science will influence institutional priorities as well as the distribution of resources and administration of funding.

Given the capacity of open science to increase the impact and reach of WIN's research efforts and elevate WIN's reputation globally, WIN is committed to providing resources and support to facilitate individual researchers in adopting open science practices.

The form of this support will depend on identified needs but may include dedicated personnel and curated educational material to facilitate open science activities such as data formatting and uploading, while keeping up to date on changing trends in this fast-paced field.

WIN will regularly evaluate their performance regarding open science to identify areas where additional support is needed. Some of the specific ways WIN intends to support open science are provided with each of the guiding principles outlined in this document.

Overarching Consideration for Implementation of Open Science Guiding Principles:

FAIR PRINCIPLES:

All aspects of open science, (including those described in the principles below) should follow the **FAIR principles** of Findability, Accessibility, Interoperability, and Reusability. In brief, research products should be processed in such ways that humans and machines can find, access, link and re-use them.

RESEARCHER AUTONOMY:

WIN supports the autonomy of its stakeholders, including but not limited to researchers, staff, trainees and patients, through recognizing their right to decline to participate in research and associated activities under an open science framework if it were to be perceived to have a negative impact on them.

DATA GOVERNANCE INCLUDING INDIGENOUS DATA SOVEREIGNTY:

WIN recognizes that certain values and ethical imperatives can impact how and when WIN's open science principles should be implemented.

As such WIN researchers are encouraged to examine as thoroughly as possible the full implications of their open science actions when following these guiding principles. For example:

› *In handling information and/or materials originating from patients, WIN recognizes the primacy of safeguarding the dignity and privacy of patient participants and respecting the rights and duties owed to them through the informed consent process.*

INDIGENOUS DATA SOVEREIGNTY:

WIN acknowledges that the movement towards open data and open science will in some cases conflict with Indigenous Peoples' rights and interest in controlling and stewarding Indigenous data and Indigenous knowledge. An approach to open science that disregards those interests may exacerbate existing power differentials and the historical context of exploitation and dispossession.

WIN is committed to ensuring that its open science approach respects the rights and interests of all parties involved. To demonstrate this respect, WIN's approach to open science will explicitly acknowledge the precedence of Indigenous rights and interests in their data and knowledge. At the root of any properly formed approach to open science must be the values of respect, an absence of harm, and meaningful participation. Only by establishing this foundation can science genuinely become 'open' to all those it impacts.

WIN will work with Indigenous stakeholders to ensure that any Indigenous data and knowledge is handled in a way that respects their rights and interests. For more information, including what constitutes Indigenous data and knowledge, please see the **CARE Principles for Indigenous Data Governance**.

FAIR PRINCIPLES | **RESEARCHER AUTONOMY** | **DATA GOVERNANCE**

PRINCIPLE 1: OPEN DESIGN

This principle advocates for integrating open science practices during the planning stages of research projects. It encourages ethical consideration of data sharing implications and emphasizes practices such as preregistration, transparent reporting of methods, and the use of open software and data.

PRINCIPLE 2: OPEN PHYSICAL RESOURCES

Researchers are encouraged to openly share physical materials and tools used in experiments, facilitating replication and innovation. Strategies for sustainable sharing, resource availability statements, and acknowledgment of contributions are recommended.

PRINCIPLE 3: OPEN DIGITAL TOOLS AND SOFTWARE

This principle promotes the open sharing of digital resources, such as algorithms and software code. Researchers are encouraged to use open-source repositories, share hardware schematics, and ensure reproducibility through standardized data analysis methods.

PRINCIPLE 4: OPEN DATA AND INFORMATION

To enhance reproducibility and discovery, this principle advocates for making all scientific information publicly available, including numerical data, models, algorithms, and data sources. Data availability statements, open sharing of data, and use of standardized data formats are emphasized.

PRINCIPLE 5: OPEN ACCESS PUBLICATIONS AND KNOWLEDGE MOBILIZATION

Researchers are encouraged to make publications freely accessible online and to embrace preprints for rapid dissemination. This principle emphasizes the importance of sharing research in formats understandable to stakeholders beyond academia.

PRINCIPLE 6: OPEN INTELLECTUAL PROPERTY

Minimizing restrictions on open ac-cess and use of shared outputs due to intellectual property is the focus of this principle. Transparent assessment of IP, open licensing, and exploring open-science-compatible commercialization avenues are highlighted, while emphasizing sustainability and non-restrictive IP protection.

Principle 1: Open Design

WIN and its researchers will incorporate open science practices into research programs during the experimental design phase so that research can avail itself of the added value inherent in open science in a proactive manner appropriate to the research context.

Best Practises for WIN Researchers

ETHICS APPROVAL OF OPEN SCIENCE:

When applying for research ethics to the Health Sciences, Non-Medical and/or animal care boards, the downstream and long-term implications of data and material sharing should be considered. For example, where appropriate in studies involving human research participants, the informed consent materials should include language clearly explaining how data and/or specimens will be shared, including possible future uses.

TRANSPARENCY IN UPDATING EXPERIMENTAL DESIGNS:

Whether or not an experimental design is preregistered, researchers should be transparent in the reporting of results, including distinguishing between planned and unplanned analyses. Where possible researchers should use platforms that allow them to share new versions of research plans as they are updated to account for research context.

REDUCING REDUNDANCY:

Redundancy in experimental design can be reduced by carefully reviewing existing openly shared scientific resources. These resources can be used to refine and optimize the current research question so as not to waste effort to needlessly replicate work. One example is using openly shared data relevant to the proposed research question to calculate a study's power requirement before starting an experiment.

Best Practises for WIN Researchers (continued)

RESEARCH DATA MANAGEMENT:

Research Data Management and Sharing Plans should be created as a part of designing experiments so that the ways research data will be collected, stored, and shared are clear from the start. Data management and sharing plans can and should be updated as appropriate to the research context. The original plan, and any updates, should be publicly shared, when possible.

OPEN PARTICIPATION IN DESIGN:

Researchers should consider including representatives of research participants in the ideation of research questions and the design of research programs, for example including a patient representative in the formulation of relevant research questions and the design of experiments conducted with the relevant patient population.

PREREGISTRATION:

Wherever possible and appropriate, experimental plans should be preregistered before or during the development of an application to the research ethics board, including documentation of hypotheses, research design, and analyses. Preregistration is part of a larger data management plan that should be considered prior to starting a research endeavour.

USING OPEN DATA:

Researchers should investigate existing openly shared data and its relevance to their proposed research as part of their experimental ideation phase.

USING OPEN SOFTWARE:

Suitable, high quality and cost-free open-source software should be used by researchers where possible, to reduce the barriers for others who wish to reproduce or build upon reported results.

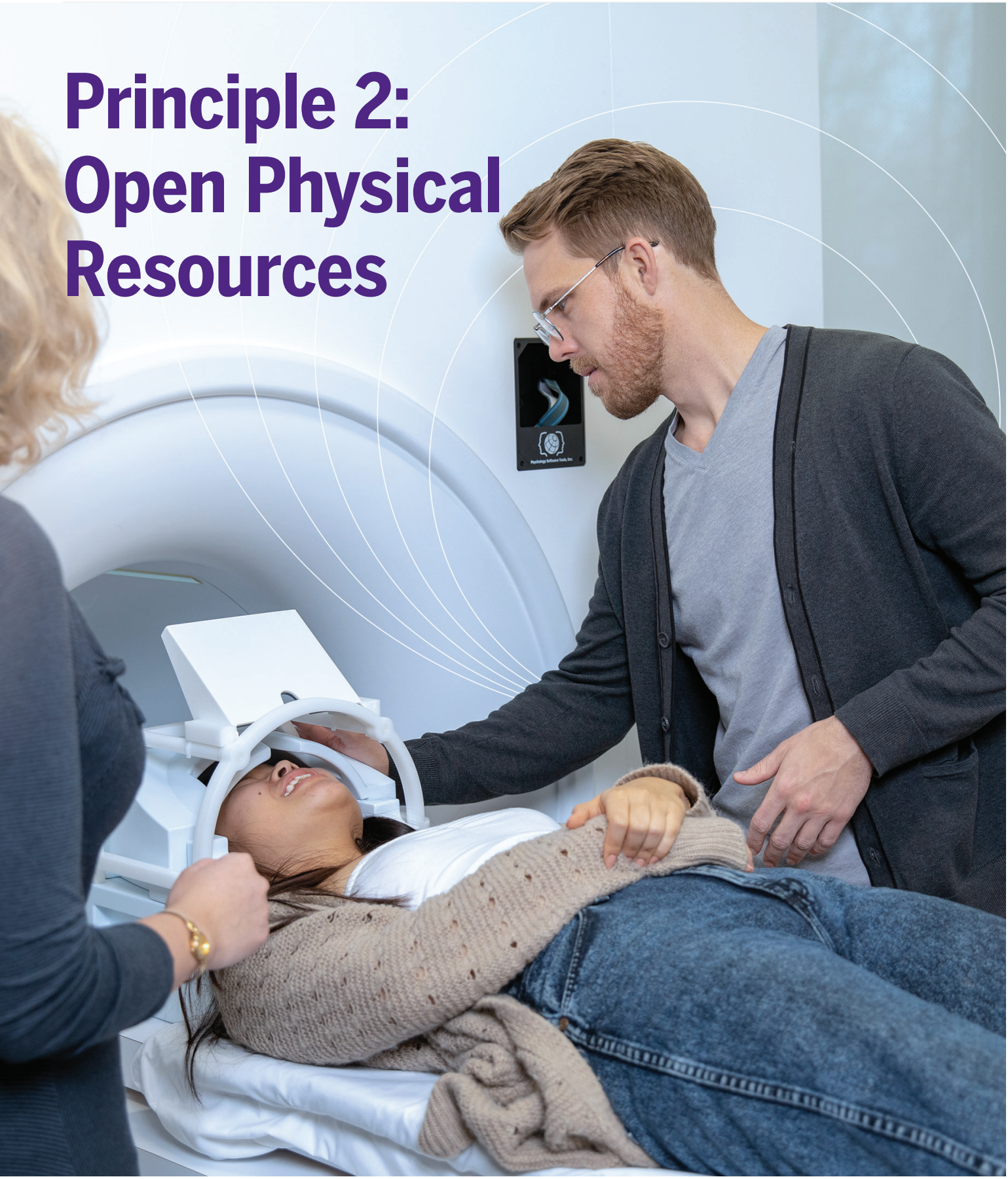
REGISTERED REPORTS:

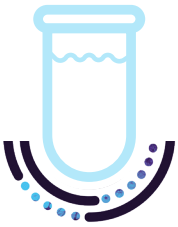
Publishing articles as Registered Reports should be considered when appropriate.

WIN will facilitate, support, and/or encourage:

- Wider adoption of open science in all research by directly working with Western's Ethics Office to develop a streamlined process to include data sharing and other open science activities in ethics applications.
- Making existing platforms and best practices that support research data management, sharing plans, and preregistration (e.g., Portage and the Open Science Framework) widely available. Where a platform does not exist, WIN may support the development of novel infrastructure.
- Making journals that publish results relevant to their field and accept Registered Reports easy to identify.
- Engaging with key stakeholders at Western—including the Libraries and Vice President (Research) Office—to ensure that university approaches to data management both support and promote open science.
- The development of a recognition system to ensure that proactive open science efforts, such as preregistration, creating and sharing data management plans, and publishing through Registered Reports are acknowledged.

Principle 2: Open Physical Resources





WIN and its researchers will support replication, discovery, and innovation by openly sharing the physical materials contributed by research participants as well as the physical research tools created by WIN researchers and their collaborators in a way that sustainably supports their long-term value.

Best Practises for WIN Researchers

SHARING PHYSICAL MATERIAL:

The sustainable sharing of physical materials acquired during experiments or contributed by research participants, including biospecimens and cell lines derived therefrom, should be considered during experimental ideation, particularly when this resource is limited. This could include:

- Identifying existing biobanks that store and share materials of the type being collected.
- Including specific budget requests for expenses, like biobanking fees, in funding applications.
- Where reasonable, collecting additional biospecimens to allow sharing for replication or novel research.
- Including resource sharing/banking in research ethics applications.

MATERIAL, RESOURCE, AND TOOL AVAILABILITY STATEMENTS:

Whenever possible, researchers should include in preprints and published articles a statement clearly stating where and under what conditions materials, resources, and tools have been openly shared.

ACKNOWLEDGMENT AND CONTINUED OPENNESS IN SUBSEQUENT USE:

Where appropriate, researchers should share resources and tools under terms where the user; (1) agrees to acknowledge those who contributed to the creation of the resource or tool and/or; (2) agree to share further modifications of those resources and tools openly and/or; (3) agree to share data derived from the use of those resources and tools openly.

WIN will facilitate, support, and/or encourage:

- Creating strategies and infrastructure to manage physical contributions and other research resources and tools in a way that is financially self-sustaining to preserve long-term value. This may include:
  - *Identifying existing biobanks and repositories that serve researcher needs.*
  - *Assisting in the creation of language to include in funding applications specifically detailing the importance and costs of sharing physical materials.*
- Supporting researchers engaged in creating or maintaining local infrastructure and initiatives that serve the needs of the WIN community.

Principle 3: Open Digital Tools and Software

WIN and its researchers will ensure digital tools and resources (such as algorithms, software code, and hardware schematics) are made openly available with minimal restrictions on reuse.

Best Practises for WIN Researchers

SHARING DIGITAL TOOLS AND RESOURCES:

- Openly sharing experimental methods, protocols, and hardware schematics appropriate for repositories and platforms.
- Openly sharing software in a source code form via appropriate repositories and platforms with version control.
- Openly sharing schematics, building instructions, parts lists, and relevant 3D modeling files for research equipment created by researchers via appropriate repositories and platforms.

REPRODUCIBLE DATA ANALYSIS:

Unique challenges need to be considered to ensure digital resources, used or created, can be implemented more broadly. Research should consider factors to allow reproducibility in data analysis (e.g., workflow management systems, and containerization).
See Material, Resource, and Tool Availability Statements in Principle 2.
See Acknowledgement and Continued Openness in Subsequent Use in Principle 2.

WIN will facilitate, support, and/or encourage:

- Promoting digital tools to facilitate data format standards to allow the use of automated sharing, processing and reuse of large data sets.
- The creation, maintenance, and curation of peer-to-peer knowledge-sharing networks, for example through the creation of wikis for resources created or used by the community.
- The development of information and communication technology solutions to track users, uses and the diffusion of digital resources and tools to help ensure proper acknowledgement and recognition.

Principle 4: Open Data and Information

WIN and its researchers will support reproducibility, discovery, and innovation by making the scientific information used in published research—including full numerical data, as well as information on the models used, data sources, algorithms, etc.—publicly available in appropriate repositories. This includes data products generated through collaborations and research partnerships – whether with commercial, philanthropic, or public sector actors.

Best Practises for WIN Researchers

DATA AVAILABILITY STATEMENTS:

Researchers should include clear language in all published work indicating whether the data underlying the results in that paper have been shared and linking to the repository where it is shared. If sharing data is not possible due to ethical constraints or because it would compromise future research activities, researchers should use the published work's Data Availability Statement to transparently communicate the rationale for withholding the data associated with publications and set a clear timeline for when and under what conditions the data will be made available.

OPEN SHARING OF DATA:

Researchers should make the data used to produce the reported results openly available and citable in a public repository no later than the publication date of the first article that reports the results.

LEVELS OF DATA SHARING:

Researchers should consider the format of greatest value. Although raw data allows the most robust reproducibility, it can result in substantial costs due to the size and complexity of the data. Often intermediate results are better suited for researchers to access the data for reuse.

DE-IDENTIFICATION AND ANONYMIZATION:

To maximize the open sharing of data contributed by research participants while protecting their privacy interests, researchers should apply appropriate de-identification and anonymization methods to shared data.

METADATA AND OPEN DATA FORMATS:

Researchers should ensure that all shared data includes rich metadata and use open standardized data formats where appropriate formats exist (e.g., BIDS).

WIN will facilitate, support, and/or encourage:

- Early dissemination of data through the creation of centralized procedures such as a centralized informatics infrastructure that combines the purposes of long-term, secure data curation and archiving for the PI, and of data sharing with the PI's team members, collaborators, or the public, at the PI's discretion.
- A recognition system to ensure their open science efforts regarding data sharing are acknowledged.
- Aggregating the open data repositories and facilitating data formatting and uploading as much as possible.

Principle 5: Open Access Publications and Knowledge Mobilization

WIN and its researchers will make all publications accessible online, free to access by any user, with no technical obstacles and minimal restrictions on reuse. In addition, researchers should endeavour to make their research meaningfully accessible to stakeholders beyond academia by sharing results in a form understandable by those stakeholders.

Best Practises for WIN Researchers

PREPRINTS:

To ensure that research results are disseminated as rapidly as possible, researchers should consider sharing preprints of submitted articles in appropriate preprint repositories.

DATA AND SOFTWARE CITATION:

Where papers rely on openly shared data and open-source software, researchers should cite the repository where these resources are shared using appropriate data and software citation methods.

OPEN ACCESS TO PUBLICATIONS:

Researchers can use self-archiving (Green Open Access) or Open Access publishing (Hybrid/Gold Open Access) to make their articles open access.

KNOWLEDGE MOBILIZATION:

Researchers should consider broader knowledge mobilization plans that may be targeted to specific populations outside of academia such as clinicians, teachers, research participants, patients, policymakers, the general public and other potential knowledge users.

WIN will facilitate, support, and/or encourage:

- Working with Libraries to ensure the open access archiving at Western meets or exceeds not only the minimum requirements imposed by funding agencies but is a truly viable model for open knowledge dissemination without the arduous costs imposed by publishers.
- Advocating where possible for greater default open access to ensure individual researchers are not burdened with often unfair open access fees.
- Working with communications teams (in-house, Western Research and/or Central communications) to assist with wider knowledge dissemination and translational activities to make research outputs more accessible to society.

Principle 6: Open Intellectual Property

WIN and its researchers will minimize the restrictions on open access and use of shared scientific outputs due to intellectual property or other legal restrictions, whether those resources are created in collaboration or partnership with academic, philanthropic, or private sector actors.

Best Practises for WIN Researchers

SUSTAINABILITY:

Imposing intellectual property or contractual restrictions to ensure the long-term value of and sustainable access to an output—for example by securing cost recovery—is not contrary to WIN's open science approach.

NON-RESTRICTIVE INTELLECTUAL PROPERTY:

Non-restrictive IP protection such as (1) trademark, certification marks and other signs and (2) defensive patent rights should be obtained as needed to promote WIN's open science mission.

Best Practises for WIN Researchers (continued)

TRANSPARENT AND GOAL ORIENTED ASSESSMENT OF APPROPRIATE IP:

Where researchers believe the use of restrictive intellectual property or contractual restrictions on outputs are needed—for example to protect research participant privacy or maximize the impact of discoveries through commercialization—they should be as transparent as practically possible about (1) the reasons for why such restrictions are sought and (2) what those restrictions mean for the reuse of outputs.

OPEN LICENSES:

Researchers should apply appropriate open licenses to research outputs. Open licenses include those that require proper attribution and those requiring modifications to be shared openly. The license used should be clearly indicated on the page where the output is shared. This can include:

- Open Licences for publications and other textual or visual outputs (e.g., Creative Commons Licenses).
- Open-Source Licences for software (e.g., licences that are approved by the Open-Source Initiative).
- Open Data Licences should be applied to all shared data.

OPEN SCIENCE COMPATIBLE COMMERCIALIZATION, TRANSLATION, AND PARTNERSHIPS:

When considering paths to translating and commercializing discoveries, those that do not rely on restrictive early IP (e.g., patents) should be explored, for example:

- Open-Source Software Commercialization
- Open Hardware Commercialization
- Open Drug Discovery Models
- Open Science Partnerships
- Open Educational Resources (e.g., Open Textbooks)

FREEDOM TO OPERATE:

Where intellectual property or contractual restrictions are sought for the sake of commercialization of research output, researchers should endeavour to negotiate agreements that allow the output to be made freely, non-exclusively, and irrevocably available for research, educational and humanitarian purposes anywhere in the world and that intellectual property or contractual rights do not limit the freedom-to-operate of any entity, public or private, to use other outputs or results of research conducted by the WIN community.

WIN will facilitate, support, and/or encourage:

- Researchers wishing to pursue research, collaboration, innovation, and translation strategies that explicitly forgo restrictive intellectual property.
- Working with Research Western to create viable open science-compatible options for partnerships, commercialization, and translation.
- Develop measures to ensure freedom-to-operate in respect of the use of data and other research outputs arising from WIN research.

We are immensely grateful to the Open Science Steering Committee, for their outstanding dedication and effort in developing WIN's open science guiding principles.
Our heartfelt thanks to:

Dr. Marco Prado, Dr. Ali Khan, Dr. Ryan Salewski, Dr. Daniel Ansari, Dr. Tim Bussey, Dr. Jessica Grahn, Dr. Jody Culham, Dr. Jörn Diedrichsen, and Dr. Andrew Pruszynski

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