

Open science in play and in tension with patent protections

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ABSTRACT

The open science (OS) movement has garnered increasing support in academia alongside continued financial and reputational incentives to obtain intellectual property (IP) protections over research outputs. Here, we explore stakeholder perspectives about intersections between OS and IP to inform the development of institutional OS guidelines for the neurosciences in Canada. We held six focus groups and three interviews with 29 faculty members from a major research and clinical center in Canada. The semi-structured interview guide probed perspectives on the respective roles of patents and OS in neuroscience-related research. We applied thematic content analysis to the transcript data, and extracted 12 major themes and 30 subthemes. Participants perceived a conflict between OS ideologies and the inherently restrictive nature of patents, and highlighted the importance of autonomy, justice, and respectful, culturally safe research practices in any future adoption of OS. Overall, the data suggest that a hybrid OS-IP policy model supported by local expertise may be best suited to meet the priorities and values of the community while mitigating perceived threats. This model includes expanded education about patenting, incentivized data sharing and collaboration, and tangible

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resources to support implementation of OS that includes skilled support in digital research infrastructures.

KEYWORDS: Ethics, intellectual property protections, open science, policy, qualitative research

I. INTRODUCTION

Open science (OS) is an increasingly popular movement that promotes sharing and communication of all aspects of research design, methods, and outputs. The objective of OS is to reduce obstacles to tools, data, and knowledge, with the end goal to accelerate the pace of scientific discovery and create a culture of accountability that increases public trust in science.

In 2021, the United Nations Educational, Scientific and Cultural Organization (UNESCO) released a report endorsing open, transparent, and inclusive scientific practices for the landscape of international collaboration,¹ marking a global shift toward OS. Indeed, worldwide, open-access databases consolidating genomics and imaging studies have been increasing rapidly in number.² For research on brain and mind, which is our specific focus here, international, open-infrastructure initiatives such as the European Human Brain Project (<https://www.humanbrainproject.eu/en/>), BRAIN Initiative (<https://www.braininitiative.org/>), OpenfMRI project (<https://openfmri.org/>), and Canadian Open Neuroscience Platform (<https://conp.ca/>) have been landmark initiatives. These global trends have motivated many institutions to develop guidelines to support OS practices and infrastructure. Addressing the role of intellectual property (IP) protections over research outputs is a necessary component of such guidance, but it is one that remains debated.^{3,4} Here, we focus specifically on such debates for research and innovation in the biosciences and brain and mind research.⁵

In Canada, two major models have successfully advanced and integrated OS frameworks. The Structural Genomics Consortium (SGC), established in 2004 at the Toronto General Hospital in the province of Ontario, is a not-for-profit, multinational public–private partnership stewarding the discovery of medications to target disease. The SGC open access policy was first developed to facilitate the sharing of human protein structures through open data repositories.⁶ Patents and other forms of IP

1 UNESCO. *UNESCO Recommendation on Open Science* (2021). Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000379949>.

2 Choudhury, S., Fishman, J.R., McGowan, M.L., Juengst, E.T., *Big Data, Open Science and the Brain: Lessons Learned from Genomics*, *FRONT. HUM. NEUROSCI.*, 8 (2014). <https://doi.org/10.3389/fnhum.2014.00239>.

3 European Commission. (rep.). *Open Science and Intellectual Property Rights* (2022). Retrieved from https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/ec_rtd_open-science-and-ip-report.pdf.

4 Roskams-Edris, D. *Intellectual Property Policy at the Neuro, an Open Science Institute*, *Qeios* (2020). <https://doi.org/10.32388/omuwel>.

5 Dreyfuss, R.C., Nielsen, J., Nicol, D., *Patenting Nature—A Comparative Perspective*, *J. LAW BIOSCI.*, 5, 550–89 (2018). <https://doi.org/10.1093/jlb/lxy021>.

6 Morgan Jones, M., Chataway, J., *The Structural Genomics Consortium: Successful Organisational Technology Experiment or New Institutional Infrastructure for Health Research?* *TECH. ANAL. STRAT. MANAG.*, 33, 296–306 (2021). <https://doi.org/10.1080/09537325.2021.1882673>.

were initially disincentivized and ultimately prohibited following a trial period.^{7,8} This policy has since seen long-term benefits, such as improved coordination between academia and industry, less duplication of research efforts, higher quality and more replicable science, and increased trust in the public sector. Breaking from the patent doctrine challenges OS initiatives such as the SGC to develop new means of assessing innovation and impact in the scientific landscape.⁹ Drawing upon the foundational efforts of the SGC and other relevant OS initiatives, the Tanenbaum Open Science Institute (TOSI) at McGill University was founded in 2016 to develop, promote, and oversee a cohesive set of OS guiding principles specifically for brain research centers. In this same year, with TOSI support, the McGill University-affiliated Montreal Neurological Institute (MNI) made history in becoming the world's first self-declared OS institute.¹⁰ The Hotchkiss Brain Institute of the University of Calgary and the Douglas Research Centre, also at McGill, have followed suit.¹¹ These TOSI-supported institutes treat protected IP as a matter of academic freedom, and follow policies customized to their organizational context to incentivize open routes to dissemination and translation. At the MNI, adoption of OS has led to the creation of new data sharing repositories, publishing portals, and forums to support academic–industry collaborations, notably the Open Drug Discovery Platform.¹² Clear metrics indicating the longer-term impacts of OS policy for the MNI and other TOSI-supported initiatives throughout Canada remain to be seen.

The ethical implications of OS have been discussed extensively in the literature.^{13–16} While OS seeks to democratize science and advance epistemic justice broadly, ethical challenges pertaining to privacy, informed consent, and appropriate contextualization of open access data persist.¹⁷ An overall understanding of stakeholder opinions regarding patents and OS is needed to construct appropriately tailored internal policies that are commensurate with the values, desires, and ethics priorities of the community of interest. As an example, the adoption of an OS framework at the MNI was preceded by the investigation of researcher perspectives on OS and IP. Researchers expressed concerns pertaining to resources and infrastructure needed to support OS, implications

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- 7 Structural Genomics Consortium. (2020). (rep.). Retrieved from https://www.thesgc.org/sites/default/files/fileuploads/sgc_open_science_policy.pdf.
 - 8 Poupon, V., Seyller, A., Rouleau, G.A., *The Tanenbaum Open Science Institute: Leading a Paradigm Shift at the Montreal Neurological Institute*, NEURON, 95, 1002–6 (2017). <https://doi.org/10.1016/j.neuron.2017.07.026>.
 - 9 Morgan Jones and Chataway, *supra* note 6.
 - 10 Poupon et al., *supra* note 8.
 - 11 Poupon et al., *supra* note 8.
 - 12 TOSI: Promoting Open Science across Canada. THE NEURO. (2022). Retrieved September 1, 2022, from <https://www.mcgill.ca/neuro/open-science/tanenbaum-open-science-institute-tosi/promoting-open-science-across-canada>.
 - 13 Beauvais, M.J.S., Knoppers, B.M., Illes, J., A Marathon, *Not a Sprint – Neuroimaging, Open Science and Ethics*, NEUROIMAGE 236, 118041 (2021). <https://doi.org/10.1016/j.neuroimage.2021.118041>.
 - 14 Ali-Khan, S.E., Jean, A., Gold, E.R., *Identifying the Challenges in Implementing Open Science*, MNI OPEN RES., 2 (2018). <https://doi.org/10.12688/mniopenres.12805.1>.
 - 15 Hofmann, B., *Open Science Knowledge Production: Addressing Epistemological Challenges and Ethical Implications*, PUBLICATIONS 10, 24 (2022). <https://doi.org/10.3390/publications10030024>.
 - 16 Düwell, M. *Editorial: Open Science and Ethics*, ETHICAL THEORY MORAL PRACT., 22, 1051–3 (2019). <https://doi.org/10.1007/s10677-019-10053-3>.
 - 17 Beauvais et al., *supra* note 10.

for industry partnerships, and academic freedom. Foreseeable benefits to patients and the public, motivations related to the ethical progression of science, and professional advantages were highlighted as incentives.¹⁸

At the authors' institution in British Columbia, one of the largest and most populated provinces in Canada, there is a long-standing legacy of technological innovation, commercial success, and the development of spin-off companies, particularly in the biosciences.¹⁹ These have relied heavily on the pursuit and acquisition of patents. Recently, grass-roots approaches to OS have come to fruition through forums that support collaboration, training, and sharing of open data and code among researchers (<https://braincircuits.med.ubc.ca/activities/databinge/>). Resulting practical guidance on data management and data sharing (<https://ubcbraincircuits.readthedocs.io/en/latest/>) has helped to fill gaps in OS practices in this local milieu. However, within a context that has simultaneously relied on and benefited from patents and developed the practical know-how and mechanisms to support OS, we acknowledge that there is likely no one size fits all approach to OS.

I.A. Statement of Ethics

Ethics approval for this study was granted by the University of British Columbia Behavioral Research Ethics Board (H21-01838). Participants reviewed and signed the consent form in advance of the interviews and focus groups.

II. MATERIALS AND METHODS

II.A. Participants

Faculty affiliated with a major Canadian brain research center were invited by email to participate in focus groups and interviews. The pool of participants comprises a community of over 120 investigators from academic institutions and hospitals across the province of British Columbia, with multidisciplinary expertise in neuroscience, neurology, psychiatry, and rehabilitation. Participants were recruited into separate arms of the study based on their experience with patents. Researchers who had previously filed for patent protections were identified using *Lens.org*, an online patent and scholarly literature search engine (www.lens.org), and were classified as patent-experienced for the purpose of data collection. The parallel arm of researchers had no previous experience with filing for patents. We sought to balance groups for gender, academic rank, and background where possible. While we endeavored to fit all eligible participants into focus groups to encourage and capture discursive interactions, we respected requests for one-on-one interviews.

18 Ali-Khan, S.E., Harris, L.W., Gold, E.R., *Motivating Participation in Open Science by Examining Researcher Incentives*, *eLIFE* 6 (2017). <https://doi.org/10.7554/elife.29319>.

19 University-Industry Liaison Office, The University of British Columbia. (n.d.). *UBC spin-off companies*. (Retrieved Sept. 23, 2022) (2022). <https://uilo.ubc.ca/ubc-spin-companies/full-list-spin-companies>.

Table 1. Sample interview questions

Semi-structured Guide	Abbreviated sample questions
Section 1	<i>What do you consider to be the benefits of patents and IP for neuroscience? What constitutes a useful versus a frivolous patent?</i>
Section 2	<i>Could open science and IP/patents co-exist? How might open science impact your research?</i>
Section 3	<i>Are there unique ethical considerations for patents in neuroscience in comparison to other biosciences? In what areas of the neuroscience patent landscape, if any, do you think knowledge gaps exist?</i>

II.B. Semi-Structured Guide

We developed a semi-structured interview guide based on prior literature.^{20–22} The draft was piloted with legal consultants to the project. The final version comprised 11-questions divided into three sections. The first section focused on the risks and benefits of patents; the second focused on synergies and tensions between OS and patents; and the third probed for ethical implications of patenting specifically in the context of brain and mind research.

Guides were the same for focus groups and individual interviews in keeping with qualitative methodology, and modified only to account for the differing expertise between the patent-experienced and patent-inexperienced participant groups. Sample questions are shown in Table 1, and both guides are available as supplementary material. All sessions were conducted in English, led by a moderator, and supported by a research assistant who took field notes to inform the later analytic process. The focus groups and interviews were approximately 90 minutes and 60 minutes, respectively. Recordings were deidentified and transcribed professionally. Anonymized transcripts were imported to the qualitative data analysis software NVivo QSR 12 (<https://www.qsrinternational.com/>).

II.C. Analytic Approach

We applied qualitative thematic analysis with a rich coding strategy^{23,24} to identify and summarize commonly referenced themes and subthemes and categorized them hierarchically. An initial codebook was created cooperatively with coding by three authors (AN, AR, JI) of 20% of the total transcript text. Any disagreements that arose between the reviewers at each stage of the selection process were resolved through discussion. JI undertook final decision-making where consensus could not be reached. AR and

20 Ali-Khan et al., *supra* note 18.

21 Ali-Khan, S.E., Jean, A., MacDonald, E., Gold, E.R., *Defining Success in Open Science*, MNI OPEN RES., 2 (2018). <https://doi.org/10.12688/mniopenres.12780.1>.

22 Ali-Khan S.E., Harris L.W., Levasseur K., Gold E.R., *Building a Framework for Open Science*. MNI OPEN RES., 2,2 (2015).

23 Vaismoradi, M., Turunen, H., Bondas, T., *Content Analysis and Thematic Analysis: Implications for Conducting a Qualitative Descriptive Study*, NURS. HEALTH SCI. 15, 398–405 (2013).

24 Hsieh, H.F., Shannon, S.E., *Three Approaches to Qualitative Content Analysis*, QUAL. HEALTH RES. 15: 1277–88 (2005).

Table 2. Demographics of participants

Total		N 29	% 100
Experience with IP	High	5	17
	Medium	11	38
	Low	13	45
Familiarity with OS	High	15	52
	Medium	8	28
	Low	6	20
Age	31–40	3	10
	41–50	6	21
	51–60	9	31
	61–70	8	28
	71+	3	10
Research area	Psychiatry	7	24
	Medicine	5	17
	Cellular & Physiological Sciences	3	10
	Neuroimaging	3	10
	Biomedical Engineering	2	7
	Medical Genetics	2	7
	Psychology	2	7
	Audiology & Speech Sciences	1	3
	Health & Exercise Sciences	1	3
	Pathology & Laboratory Medicine	1	3
	Pharmaceutical Sciences	1	3
Zoology	1	3	

AN coded the remaining transcripts independently allowing for further refinement of thematic codes as they emerged. The final version of the codebook is available as a supplementary material.

Intercoder reliability was determined using the Cohen’s Kappa coefficient. We calculated proportions of coded references as the number of coded references per thematic code divided by the total number of references. We identified dominant subthemes as the most frequently coded subtheme within each major theme.

III. RESULTS

III.A. Focus Groups and Interviews

We conducted six focus groups and three interviews ($N = 29$ participants total). One focus group and two interviews were held in person, and the remainder were hosted on a licensed version of Zoom. Two focus groups and three interviews were held for participants with patent experience ($N = 11$), and four focus groups included participants without patent experience ($N = 18$). Nine participants self-identified as women; the remainder as men. Self-reported information regarding participant age, familiarity with IP and OS, and research area as defined by primary professional affiliation is shown in [Table 2](#).

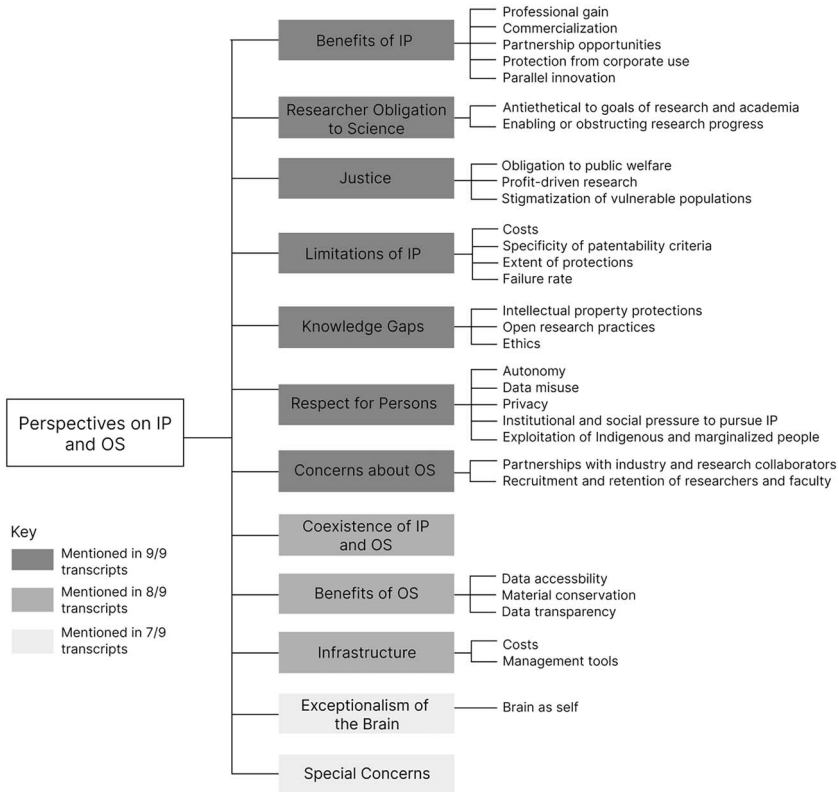


Figure 1. Coding hierarchy (order of themes represents frequency in transcripts and number of coded references)

III.B. Themes and Subthemes

III.B.1. Themes

A total of 12 major themes and 30 subthemes corresponding to 682 coded references emerged from the qualitative analysis of nine transcripts (Fig. 1). Of the major themes, seven were common to all transcripts. The interrater reliability test yielded an overall unweighted K statistic of 0.96, indicating good reproducibility of the coding hierarchy. Selected quotes presented in Results are illustrative and edited for readability.

III.B.1.1. Benefits of IP This major theme was discussed most frequently by participants (21% of coded references in 9/9 transcripts). It encompasses the various ways in which patents aid researchers and institutions who possess them. The dominant subtheme within it, *Professional Gain* (9 per cent; 9/9 transcripts), reflects the most frequently mentioned advantages of patents, which are the perceived financial gains to support laboratory and research activities together with reputational benefits associated with ownership. Notably, the value of patents as a tool for commercialization of emerging therapeutics and neurotechnologies was also referenced in all nine transcripts.

‘... in the current system, patents allow that influx of cash upfront to develop ideas...’
 – Participant #1, INT #1 (patent-experienced).

III.B.1.2. Researcher Obligation to Science This was the second-most referenced major theme (13%; 9/9 transcripts). Researchers expressed that reducing obstacles to knowledge, advancing collaboration, and using research outputs to benefit the scientific community as a whole are moral endpoints. The dominant subtheme within it, *Antithetical to Goals of Research and Academia* (7 per cent; 9/9 transcripts), reflects the tension between academic openness and the inherently restrictive properties of patents.

'... our reason for doing research is to share, to try and just discover things and disseminate it to our peers. So I'm not sure that patents and IPs are really going to play a role ...'

– Participant #1, FG #2 (patent-inexperienced).

III.B.1.3. Justice The major theme of *Justice* characterizes prescriptive notions of how patents in research ought to benefit society and constitutes 12% of the coded references (9/9 transcripts). In the dominant subtheme under *Justice*, *Obligation to Public Welfare* (9 per cent, 8/9 transcripts), participants emphasized that the benefits of research funded by the public should accrue to the public and, in particular, to patients.

'... if it's completely publicly funded, I think we have a responsibility to make that open to the public and accessible.'

– Participant #1, INT #2 (patent-experienced).

III.B.1.4. Limitations of IP This theme (11%, 9/9 transcripts) identifies drawbacks and risks associated with patents. Expenses related to applications, litigation, and management of patents as well as the time delay associated with its acquisition are components of the dominant subtheme, *Costs* (4%, 9/9 transcripts).

'... the biggest problem is really money, time, effort. You have to hire a patent lawyer; you have to search for similar patents. You have to do an enormous amount of difficult work which actually costs a lot of money and time.'

– Participant #2, FG #4 (patent-inexperienced).

III.B.1.5. Knowledge Gaps The major theme of *Knowledge Gaps* (9%, 9/9 transcripts) encompasses participants' requests for further education, training, and additional resources pertaining to patents and other IP protections, open research practices, and ethics. The largest subgroup of references to knowledge gaps related to *Intellectual Property Protections* (4%, 9/9 transcripts). Researchers sought clarity regarding the appropriateness of patenting in certain contexts, preferred avenues for pursuing patents, and the patent law system more broadly. This was particularly salient for those without patent experience.

'... I don't understand it well enough ... somebody needs to tell me more about what a patent protects.'

– Participant #1, FG #5 (patent-inexperienced).

III.B.1.6. Respect for Persons The theme *Respect for Persons* (7%, 9/9 transcripts) represents practices and relationships pertaining to IP and OS in which dignity is imperiled. The dominant subtheme of *Autonomy* is reflected in 7/9 transcripts and 2% of coded references. Participants emphasized the importance of choosing the direction of their research and respecting the choices of their peers.

'... if somebody feels that OK their ideas should be patented, I don't really feel like I have the right to say no, you can't do that.'

– Participant #1, FG #2 (patent-inexperienced).

III.B.1.7. Concerns about OS This theme (6%, 9/9 transcripts) reflects the potential conflicts between work that is already ongoing and a potentially new mandate associated with OS. The subtheme of *Partnerships with Industry and Research Collaborators* (4%, 9/9 transcripts) captures the perception that collaborations between researchers and government agencies, private funders, and other researcher groups and departments may be complicated and even jeopardized by an OS policy.

'... A lot of these partnerships and I think the industry, third party stakeholders would be considerably less interested if there was no way to commercialize.'

– Participant #1, FG #3 (patent-experienced).

III.B.2. Subthemes

Five (5) major themes emerged in a subset of transcripts. *Coexistence of IP and OS* (7% of references, 8/9 transcripts) reflects how both patent and OS pursuits can be facilitated in parallel, with the majority of participants favorably disposed to a flexible model. In the theme *Benefits of OS* (5% of references, 8/9 transcripts), researchers discussed the merits of increased data sharing, transparency, and access to external research samples and materials. *Infrastructure* (3% of references; 7/9 transcripts) encompasses how tangible tools, funding, and staff are critical resources for facilitating adherence to an OS policy. Some participants cited concerns that current OS resources are not yet sufficiently developed to support experimental demands. *Exceptionalism of the Brain* (3% of references, 7/9 transcripts) reveals different attitudes regarding the role of patents specifically in the context of brain and mind research. The divergence of opinions made this a theme with considerable divisiveness. A number of participants expressed that the brain is a unique biological entity and should be treated with special consideration in the patent space. These participants raised questions and concerns about the morality of patenting technologies that may interfere with cognitive, emotional, or behavioral phenomena. Others, however, did not view brain-related patents as ethically distinct from patents in the other biosciences. Finally, *Special Concerns* (2% of references, 7/9 transcripts) identifies ethical implications pertaining to epistemological differences in knowledge sharing, data ownership and privacy, and culturally safe research practices for OS in research partnerships with marginalized groups, including Indigenous communities.

IV. DISCUSSION

The results of this study suggest that faculty members affiliated with a wide range of research and clinical institutions at a major neuroscience center in British Columbia are cautiously optimistic about a move toward OS. Faculty frequently reported independent steps they have taken to align research practices with the OS standards, reflecting a longstanding endorsement of OS values and recognition of its benefits. Concerns about OS largely addressed potential changes in research practices and the need for more infrastructure beyond existing platforms. By contrast, concerns about patents focused on legal expenses and ethical implications of restricted access to research materials.

These distinct realms of concern between OS and IP provide further evidence of an ideological alignment with OS values, suggesting that fear of top-down institutional change attenuates enthusiasm rather than the principles of OS themselves. This perception may be a product of the phrasing in TOSI Principle #4 used by the flagship MNI TOSI program to which participants in this study were introduced:

Subject to patient confidentiality and informed consent given, neither The Neuro nor its researchers in their capacity as employees or consultants of McGill or The Neuro will obtain restrictive IP protection in respect of any of their research outputs, whether done internally or with collaborators (<https://www.mcgill.ca/neuro/open-science/open-science-principles>).

Such language, especially if taken out of context, may present strict divestment from patents and other forms of IP as an entry requirement to OS. It may also contribute to dramatic expectations of how quickly research practices would need to adapt and the extent of practices requiring adaptation. However, the MNI is actually flexible in its approach, operating under an ‘*as open as possible, as closed as necessary*’ ideology; for example, open data sharing may be restricted in order to protect patient or research participant privacy.²⁵ Thus, transparency and clear articulation of specific cases in which patents are considered to be useful and appropriate, or alternatively, restrictive and frivolous, may assuage concerns. Support may be increased, therefore, when principles are operationalized and discipline-specific education is embodied in a balanced and concrete approach to OS.

We also found that strict adherence to TOSI Principle #4 may hinder researcher autonomy and scientific advancement. Concerns pertaining to researcher autonomy have been cited in previous work,²⁶ leading several institutions to instantiate researcher and participant autonomy as a guiding principle; essentially, the option to opt-out of research or activities operating under an OS framework. The data from this study suggest that researcher autonomy should be at the fore of an OS policy. As others have reported^{27,28} this approach would alleviate concerns regarding stringent, top-down policy changes as well as allow the majority of researchers in support of OS ideologies the freedom to adopt increasingly open practices within their laboratories.

25 Roskams-Edris, *supra* note 4.

26 Ali-Khan, et al., *supra* note 18.

27 *Id.*

28 Levin, N., Leonelli, S., Weckowska, D., Castle, D., Dupré, J. How Do Scientists Define Openness? *Exploring the Relationship between Open Science Policies and Research Practice*, BULL. SCI. TECHNOL. SOC. 36, 128–41 (2016). <https://doi.org/10.1177/0270467616668760>.

Many participants expressed that their primary motivation to do research lies in the advancement of science and medicine, with the ultimate goal of promoting the common good. Those familiar with pharmaceutical development expressed the view that patents are necessary for commercializing ideas and inventions. Indeed, industry is the primary source of funding for clinical trials, and businesses demand protections to safeguard their investments. Prohibiting these partnerships could impede the development of new therapeutics. However, limitations to the patent system exist, and patenting is not the only pathway to commercialization. The data suggest that researchers would benefit from information about alternative licensing practices and opportunities for innovation beyond patenting, including public subsidies and funding to support research and development.²⁹ Researchers also expressed that the translational setting poses extra challenges for OS; as some individuals engage in both, policy that requires absolute adherence to one or the other may be a poor fit.

Concerns voiced by many researchers that patents inherently introduce obstacles to research and innovation may be addressed through increased education about the short- and long-term implications of patenting. While patenting may initially delay the sharing and dissemination of research results in order to fulfill the novelty requirement—publishing work in peer-reviewed academic journals is a key example—this is only the case until the patent application has been filed. Moreover, jurisdictions such as Canada encourage dissemination by providing grace periods after public disclosure in which a patent application may still be submitted.³⁰ Knowledge gaps and misconceptions identified in this study underscore the need for programs of education about patents and IP more broadly. These may be supported through interdisciplinary collaboration and knowledge exchange between legal scholars, researchers, and scientists in relevant fields.

The findings further highlight the imperative of balancing openness with culturally respectful, collaborative practices with marginalized groups, such as Indigenous communities in Canada. Prior research has explored tensions between the OS movement and Indigenous self-determination and data sovereignty.^{31,32} The CARE principles (Collective Benefit, Authority to Control, Responsibility, Ethics) for Indigenous Data Governance³³ were designed to complement existing FAIR principles (Findable, Accessible, Interoperable, Reusable) for OS data management,³⁴ acknowledging the rights of Indigenous peoples to data, information, and knowledge that impacts their communities, and ensuring data are used in a way that aligns with their values and priorities. Existing principles that uphold Indigenous data sovereignty must be

29 Walter, M., Lovett, R., Maher, B., Williamson, B. et al., *Indigenous Data Sovereignty in the Era of Big Data and Open Data*, *AUST. J. Soc. Issues* 56, 143–56 (2020). <https://doi.org/10.1002/ajs4.141>.

30 Roskams-Edris, *supra* note 4.

31 Ali-Khan et al., *supra* note 14.

32 Ali-Khan et al., *supra* note 14.

33 Carroll, S.R., Garba, I., Figueroa-Rodríguez, O.L., Holbrook, J. et al., *The CARE Principles for Indigenous Data Governance*, *DATA SCI. J.* 19 (2020). <https://doi.org/10.5334/dsj-2020-043>.

34 Wilkinson, M.D., Dumontier, M., Aalbersberg, I.J.J., Appleton, G. et al., *The FAIR Guiding Principles for Scientific Data Management and Stewardship*, *SCI. DATA* 3 (2016). <https://doi.org/10.1038/sdata.2016.18>.

operationalized within any OS policy,³⁵ while acknowledging that some aspects of the patent system are also incompatible with Indigenous ways of knowing.³⁶ For example, patents often protect the rights of an individual inventor, whereas many Indigenous communities value and prioritize collective access to and ownership of knowledge.³⁷ Projects should be evaluated individually according to their goals and partnerships to ensure meaningful engagement and culturally safe research activities.

Along with its cooperative values, the ultimate endpoints of OS in advancing scientific knowledge and public welfare resonated with the beliefs that participants expressed. As the benefits of pursuing patents depend on the nature of the research, participants supported a context-informed choice rather than strict adherence to specific policies. This approach would seek to uphold researcher autonomy and ensure best practices for research and pathways to translation tailored to the goals and priorities of individual projects. One potential risk is that a flexible and unenforceable policy could minimize the overall impact of OS at an institution. However, researchers in this study expressed deep ideological alignment with the values and goals of OS, suggesting that with appropriate infrastructure and guidance, institutional uptake would be welcome. An additional challenge is that researchers collaborating across disciplines may have different priorities and discipline-specific standards about OS and IP practices. Education supported by local institutional expertise about OS and IP will allow researchers to collaboratively weigh the advantages of each system, and choose the route that is most expeditious and beneficial for society.

IV.A. Limitations

As with all research of this nature and participation rates that represent only a fraction of a defined population, results are transferable but not generalizable. Due to the limitations of search terms on [Lens.org](https://lens.org), one focus group included a mixed sample of patent-experienced and patent-inexperienced participants. Only one female-identifying participant had experience with patenting and attended a focus group with four male-identifying participants. Research has shown that men are overrepresented among faculty members with patents in the life sciences,³⁸ although recent reports suggest that the gender gap is closing (<https://www.uspto.gov/about-us/news-updates/la-test-uspto-report-finds-32-increase-number-us-counties-where-women-patented>). Participants with interviews necessarily had more air time than those in multiple-person focus groups. As a result, the perspectives of some participants may be overrepresented in the data.

35 Carroll et al., *supra* note 33.

36 Marinova, D., Raven, M., *Indigenous Knowledge and Intellectual Property: A Sustainability Agenda*, J. ECON. SURV., 20, 587–605 (2006). <https://doi.org/10.1111/j.1467-6419.2006.00260.x>.

37 Government of Canada, *Government of Canada, Innovation, Science and Economic Development Canada, Office of the Deputy Minister, COMMUN. MARKETING BRANCH* (2020). (Retrieved Feb. 10, 2023). <https://ised-isde.canada.ca/site/intellectual-property-strategy/en/introduction-intellectual-property-rights-and-protection-indigenous-knowledge-and-cultural>.

38 Ding, W.W., Murray, F., Stuart, T.E., *Gender Differences in Patenting in Academic Life Sciences*, SCIENCE 313, 665–7 (2006). <https://doi.org/10.1126/science.1124832>.

IV.B. Ideas and Recommendations

The momentum toward OS in the neuroscience community signified by leading Canadian hubs in Montreal, Calgary, and Ontario, and the interest expressed in promoting this movement by the Canadian Tri-Agency funding bodies (https://www.sshrc-crsh.gc.ca/news_room-salle_de_presse/latest_news-nouvelles_recentes/2021/research_data_management_policy-politique_sur_la_gestion_des_donnees_de_recherche-eng.aspx), the Canadian Brain Research Strategy (www.canadianbrain.ca), Brain Canada (<https://braincanada.ca>), and others, suggests that engagement with the OS movement in this country is not only desirable but inevitable. Therefore, we recommend that the idea of OS needs to be socialized among the members of neuroscience and bioscience organizations broadly. Authentic buy-in can be maximized through:

1. Rigorous research of the interests in, priorities for, and potential impact of OS on a program, center, and institution.
2. Timely reporting of the results of the empirical work and proposals for implementation.
3. Evaluations of existing and needed infrastructure to support identified short- and long-term OS goals.
4. Building a program of resources that focus on education about OS and IP, and critically, supporting grass-roots efforts toward OS that promote collaboration.

Ultimately, the success of OS for neuroscience in Canada will turn on what it means to be an organization that upholds OS principles, with well-established definitions and metrics and transparent and flexible approaches to situating an organization in this context.

AUTHOR CONTRIBUTIONS

JJ, PP, JL: conceptualization; JJ, AR, AN: methodology; AR, AN: data analysis; JJ, AR, AN: manuscript writing; JJ, PP, JL, AN, AR: manuscript editing.

CONFLICT OF INTEREST

The authors have no financial, personal, academic, or other conflicts of interest in the subject matter discussed in this manuscript.

DATA AVAILABILITY

Ethics approval does not permit the release of raw material outside the research team for reasons of confidentiality. Aggregated data may be requested from the corresponding authors.

ACKNOWLEDGEMENTS

This work was supported by the Tannenbaum Open Science Institute (RPB-GR021989; PP and JJ) and in part by the Canadian Institutes for Health Research

(CIHR) in partnership with the ERAnet Neuron program (#ERN-174185; JI) and the Dynamic Brain Circuits cluster at the UBC Djavad Mowafaghian Centre for Brain Health (RRID:SCR_019086). JI is Distinguished University Scholar, UBC Distinguished Professor in Neuroethics supported by the North Family Foundation, and Director of Neuroethics Canada. PP is a Professor of Psychiatry and a faculty member of the UBC Michael Smith Laboratories, the UBC Centre for Brain Health, and the UBC Institute for Mental Health. JL is a staff member at the UBC Centre for Brain Health and managing director of its NeuroImaging and NeuroComputation Centre. The authors thank Prof. Dr. Tade Spranger and his team in Bonn, Germany, for their insights and collaboration on IP and human rights; Kate Gaudry, Dylan Roskams-Edris, Roland Nadler, and Stacey Anderson-Redick for valuable advice; and Ashley Lawson for early contributions to the design of the research.