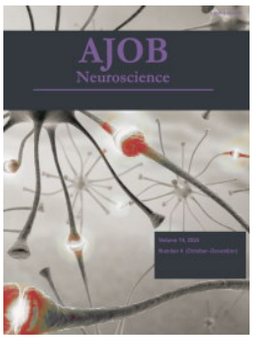

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Selected Abstracts from the 2024 International Neuroethics Society Annual Meeting

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ABSTRACT

Selected Abstracts from the 2024 International Neuroethics Society Annual Meeting

The following abstracts were selected by AJOB-Neuroscience judges as the best submitted to the International Neuroethics Society 2024 Annual Meeting based on merit, novelty, relevance, and contribution to the field of neuroethics. The scores were tallied and the top abstracts appear in alphabetical order by first author surname.

To Explant or Not to Explant: Deliberations on the Explantation of Neural Devices Within Research Ethics Committees

Katherine Bassil[a,b] and Karin Jongsma[a]

[a]University Medical Center Utrecht; [b]Maastricht University

Neural implants such as deep brain stimulation (DBS) offer great promises for patients with sensory and motor impairments or even psychiatric disorders (White et al. 2015). Implanted devices may need to be explanted for a number of reasons including malfunctioning device, inflammation, lack of post-trial access in the case of research studies, or by the request of a user among others (Hansson 2021; Klein 2016; Sierra-Mercado et al. 2019). Research Ethics Committees (RECs) have a role in deciding when and how explantation of neural devices ought to take place. For instance, in the Netherlands, some RECs Dhave demanded to explant neural devices once a clinical trial has ended, whereas others have demanded post-trial support in some research trials. However, the explantation of neural devices is accompanied with a number of medical and psychological risks (Gilbert, lenca, and Cook 2023; Hansson 2021) which requires the careful balancing between the positive and negative effects of the possible options (to explant or not to explant) and hence prevent the arbitrariness of such decisions.

Little is understood about how RECs in general, but in particular in the Netherlands, deal with decisions related to the explantation of neural implants (Sierra-Mercado et al. 2019). To better understand the role of RECs, we approached different REC secretaries within the Netherlands via email, with a list of open-ended questions including the explantation of neural devices, on informed consent and post-trial care, on post-trial responsibilities, and reasons to explant.

From the gathered responses, we anticipate that the RECs in the Netherlands may deal with explantation on a case-by-case basis, they may not have specific guidelines in place to deal with the explantation of neural devices after the end of a clinical trial. Responses from Dutch RECs could shed light on overlooked challenges on the explantation of neural devices that may guide future research practices to improve the ethical and safe explantation of neural devices in Europe and internationally.

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What's Left of Moral Bioenhancement? Reviewing a Fifteen-Year Debate

Hunter Bissette, Dario Cecchini, Ryan Sterner, Elizabeth Eskander and Veljko Dubljević

North Carolina State University

Should we implement biomedical interventions like psychopharmaceuticals or brain stimulation that aim to improve morality in society? Since 2008 (Douglas 2008;

Persson and Savulescu 2008), moral bioenhancement (MBE), has received considerable attention in bioethics, generating wide scholarly disagreement. However, reviews on the subject are few and either outdated (Specker et al. 2014), not structured in method (Kudlek 2022), or limited in scope (Macpherson, Roqué, and Segarra 2019). Our paper addresses this gap by providing a scoping review on the last fifteen years of debate on MBE (from 2008 to 2022).

We analyzed a sample of 138 peer-reviewed English articles selected from PubMed and Web of Science. To enhance clarity, we map the debate into three key areas: the conceptual foundations of MBE (*foundational questions*), the practical feasibility of MBE (*practical questions*), and the normative legitimacy of MBE (*normative questions*).

Foundational questions turn out to be the most debated (136 out of 138 selected papers contributed to this category), indicating substantial disagreements on the conceptualization of MBE. More specifically, our analysis reveals a shift from a universal interpretation of MBE to a more pragmatic one, integrated with other types of bioenhancement or already existing practices such as therapy, rehabilitation, and education. The discussion about the practical feasibility of MBE revolves primarily around the scarcity of safe biomedical interventions for MBE and the incompatibility of MBE with liberal democracy. Finally, the literature's response to normative questions differs according to the type of question. The majority of the publications examining the obligatory nature of MBE are against it ($n=33$, 60%). However, the surveyed literature is much more favorable to the permissibility (52 articles, approximately 83%) and the desirability of MBE (43 articles, 75%). Additionally, we divide arguments for and against MBE into two broad categories of normative arguments: *a posteriori* arguments, which concern the moral consequences of MBE, and *a priori* arguments, which concern the principled moral acceptability of MBE. Beyond identifying established conclusions and research gaps, we aspire to assist scholars in navigating the diverse array of research inquiries surrounding MBE and to foster the emergence of novel insights in this field.

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Attitudes Towards Disease Model Explanations of Chronic Pain Among Canadian and US Adults Without Chronic Pain: A Contrastive Vignette Technique Study

Iris Coates McCall[a], Brooke Magel[a], Rachael L. Bosma[b,c], Chris Lo[b,d], Javeed Sukhera[e], Jennifer A. Chandler[f], Emeralda Burke[g], Dwayne Patmore[g], Karen D. Davis[b,h] and Daniel Z. Buchman[a,b,h]

[a]Centre for Addiction and Mental Health; [b]University of Toronto; [c]Women's College Hospital; [d]James Cook University; [e]Hartford Hospital/Institute of Living; [f]Centre for Health Law, Policy and Ethics, University of Ottawa; [g]Independent Researcher; [h]University Health Network

Introduction: Neuroimaging technologies have informed the way that we understand the brain's role in chronic pain. The identification of brain-based biomarkers of chronic pain may help legitimize chronic pain as a disease of the brain and thereby reduce stigma. However, it is unknown whether brain disease explanations will influence chronic pain stigma. The goal of this study was to examine the influence of a brain disease explanation of chronic pain on the degree to which adults without chronic pain stigmatize people with chronic pain.

Methods: We conducted a contrastive vignette study with $N=508$ adults in the U.S. and Canada without chronic pain. Participants were randomized to one of five vignettes about a person named Sam whose physician explains their chronic pain is due to either (1) no physical cause, (2) biological, psychological, and social factors, (3) a disease, (4) a brain disease, or (5) a brain disease+brain biomarkers (with an accompanying brain illustration). Participants completed validated scales to measure estimated pain level, pain exaggeration, trustworthiness, sympathy, and social distance/stigma related to the vignette.

Results: Participants who saw the disease and brain disease vignettes perceived Sam to be in more pain than the no physical cause vignette. Participants who viewed the disease or brain disease+biomarkers vignette thought Sam was less likely to exaggerate their chronic pain compared to the no physical cause vignette. The disease, brain disease, or brain disease+biomarkers vignettes increased the likelihood of Sam being perceived as truthful compared to the no physical cause vignette. Participants who saw the disease or brain disease+biomarkers vignette elicited greater sympathy for Sam compared to the no physical cause vignette. There was no statistically significant difference in the degree of stigma experienced toward Sam based on the vignette.

Conclusion: Brain- and disease-based explanations of chronic pain may influence how people without chronic pain perceive specific dimensions of pain-related stigma. This has implications for public awareness and anti-pain stigma campaigns. To follow-up on these findings, we will conduct qualitative interviews to explore the lived

experience of people with chronic pain and how it shapes their understanding of brain disease explanations and stigma.

ORCID

Iris Coates McCall http://orcid.org/0000-0002-8984-5928

Guideline-Based Care for Psychiatric Electroceuticals: Results from a National Survey of Board-Certified Psychiatrists

Joshua E. Cunningham[a], Robyn Bluhm[b], Eric D. Achtyes[c], Aaron M. McCright[b] and Laura Y. Cabrera[d,e]

[a]College of Human Medicine, Michigan State University; [b]Michigan State University; [c]Western Michigan University Homer Stryker M.D. School of Medicine; [d]Pennsylvania State University; [e]Rock Ethics Institute, Pennsylvania State University

Background: Psychiatric electroceutical interventions (PEIs) are treatments that use electrical or magnetic stimuli to treat psychiatric conditions (Famm et al. 2013). Clinical practice guidelines (CPGs) are systemically developed to assist practitioners in making appropriate clinical decisions and may inform psychiatrists' knowledge about PEIs (American Psychiatric Association 2001; McClintock et al. 2018; Woolf et al. 1999). While CPGs may potentially reduce morbidity and mortality, improve patient quality of life, and improve efficiency and quality of healthcare (Woolf et al. 1999), they also can end up encouraging ineffective, harmful, or wasteful interventions (Woolf et al. 1999). Moreover, they may be rendered rapidly out-of-date given the dynamic nature of science. Since there is no "one size fits all" treatment, guidelines cannot provide individualized direction. While CPGs suffer from these limitations, they have shown to improve patient outcomes when applied correctly (Girlanda et al. 2017) and may be a useful tool for guiding physician use of PEIs.
Objectives: To provide insight on psychiatrists' main preferences for the creation of optimal PEI guidelines.
Methods: We administered a survey with an embedded experiment to a national sample of board-certified psychiatrists ($n = 505$). We randomly assigned respondents to one of 8 conditions using a full factorial experimental design: 4 PEI modalities [ECT, rTMS, DBS, or adaptive brain implants (ABIs)] by 2 depression severity levels [moderate or severe]. We analyzed the survey data with ANOVA and multinomial logistic regression.
Results: Overall, 46.8% of psychiatrists reported that the main consideration when developing practical guidelines should be providing evidence of the safety and efficacy of these interventions. Yet, such aggregation conceals variation across modalities. For example, compared to psychiatrists assigned to ECT (20.8%) or rTMS (31.4%), greater percentages of psychiatrists assigned to DBS (61.6%) and ABIs (72.4%) reported safety and efficacy as their main consideration, while greater percentages of those assigned to ECT (16.0%) and rTMS (11.6%) reported improving systems of care delivery as their main consideration.
Conclusions: Having a better understanding of psychiatrists' main considerations for PEI guidelines can highlight areas where current guidelines have not provided needed insight for clinicians, indicate gaps in evidence, and signal that updates to existing guidelines are needed. Differences in preferences likely are related to the maturity of each modality, with ECT and rTMS being FDA-approved treatments with stronger evidence bases, and DBS and ABIs being currently experimental.

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The Prudential Value of Creativity; A Neglected Question in Neuroethics

Welles Emerson

University of Oxford

Creativity, widely defined as something that is both original and effective, is undeniably important to human beings for their happiness and survival. However,

empirical research on negative personality traits and disorders correlated with creative behaviors suggests creativity has a common etiology with (or is a shared vulnerability for) certain psychopathologies (Carson 2019). Most of these psychopathologies include a distinct type of neurocognition, Divergent Thinking (DT), as part of their symptomatology. Divergent Thinking is an important element in fluid intelligence, working memory, fluency, and flexibility. A systematic literature review shows creativity researchers broadly agree that DT is a key component in the creative process, and many scholars theorize the originality necessary for creative ideation arises from DT (Acar and Runco 2015). Could efforts to reduce psychopathologies or increase morality through genetic manipulation, pharmacological and neurological interventions, or new enhancement technologies damage our capacity for creative originality? Despite these provocative connections there is almost no work in the literature of practical ethics on the significance of creativity for well-being, beyond considering the goodness of "aesthetic experience."

This author contends we should consider creativity as an "all-purpose good" for human beings (Buchanan et al. 2002), keeping in mind correlations with ill-being do not prove causation. There is robust cross-disciplinary evidence that creativity plays an essential role in our flourishing (Gordon-Nesbitt and Howarth 2020) that exceeds a mere instrumental value. Recognizing creative cognition's prudential value as an objectively good capacity will identify it as a morally relevant consideration in ethical decisions that impact human functioning. I conclude that understanding the prudential value of creative cognition, inclusive of DT, to be a constituent part of well-being will improve the practice of neuroethics.

Finally, I consider some implications of this argument for evaluating complex ethical cases in which creative capacity or functioning could be at stake, such as the value or disvalue of treatment for certain mental health disorders, the potential use of shared candidate biomarkers to predict vulnerability for disease, disadvantage, or creative predisposition (Zwir et al. 2022) in future reproductive decision making, and the project of human enhancement (Savulescu, Sandberg, and Kahane 2011).

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Human Brain Organoid Transplantation: Testing the Foundations of Animal Research Ethics

Alexandre Erler

National Yang Ming Chiao Tung University

Human brain organoids (HBOs) are small 3D structures, made of neural tissue, that mimic various parts of the human brain. Alongside in vitro studies, researchers are increasingly exploring the transplantation of HBOs into non-human animals to study brain development, disease, and repair (Sawai et al. 2022). This paper focuses on ethical issues raised by such transplantation studies. In particular, it investigates concerns about the possibility that they might yield enhanced brain function in recipient animals, thereby significantly altering their moral status (Chen et al. 2019). Such concerns are sometimes described by speaking of the possible "humanization" of animal subjects, although I suggest that talk of brain enhancement may be more helpful in this context.

I discuss and respond to the critique, raised by major voices in the bioethics and science communities, according to which such concerns are premature and misleading (International Society for Stem Cell Research 2021). I identify the assumptions (in particular, about notions like personhood and self-consciousness) underlying this skeptical critique, and describe some objections that have been leveled at them (Koplin 2023), followed by some possible replies. I proceed to argue that while those replies do have some force, the skeptical position is nevertheless implausible, because it presupposes an unreasonably high standard of full moral status, misleadingly supported by references to "humanization." My argument appeals to David DeGrazia's idea of a "borderline person" (DeGrazia 2007), and to the need for consistency with existing animal research regulations. I outline the practical implications of my view for the conduct of studies that might result in the development of full moral status in a transplanted animal, including the need for a precautionary approach as long as important questions about the expected quality of life of enhanced animals have yet to be settled.

I conclude that far from being premature, further debate on these issues is urgently needed to help clarify the pre-requisites of full moral status, the prospects that a neural chimera might meet them in the foreseeable future, and the level of quality of life required to make it acceptable to knowingly create such a being via HBO transplantation.

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Sawai, T., Y. Hayashi, T. Niikawa, J. Shepherd, E. Thomas, T.-L. Lee, A. Erler, M. Watanabe, and H. Sakaguchi. 2022. Mapping the ethical issues of brain organoid research and application. *AJOB Neuroscience* 13 (2):81–94. https://doi.org/10.1080/21507740.2021.1896603.

Results: Findings suggest that public perceptions are in important respects incongruent with clinical guidelines. One such example is DBS, which was perceived to be more beneficial than MRgFUS, but less acceptable and less likely to be used. This incongruity is likely linked to DBS also being perceived as riskier and more invasive than MRgFUS—despite the irreversibility of MRgFUS' ablative procedure. When examining the main effects of symptomatology, we found that neuromodulation was, across technologies, perceived as significantly more beneficial, acceptable, and likely to be used by participants for motor symptoms, followed by memory symptoms, and lastly mood symptoms. These results suggest that participants may be more reluctant to alter or treat symptoms relevant to feeling and thinking compared to bodily movement.

Conclusion: The present results aim to ensure that the promises of neurotechnologies are realized together with considerations of both societal acceptance and clinical efficacy. The incongruities revealed between public attitudes toward neurotechnologies and clinical guidelines underscore the need for comprehensive dialogue and ethically informed decision-making.

Public Perceptions of Emerging Neurotechnologies Used to Target Mood, Memory, and Motor Symptoms

Rémy A. Furrer[a], Amanda R. Merner[a], Ian Stevens[a,b], Peter Zuk[a], Theresa Williamson[a], Francis X. Shen[a,c,d] and Gabriel Lázaro-Muñoz[a,c]

[a]Harvard Medical School; [b]Oregon Health & Science University; [c]MGH; [d]Harvard Law School

Background: Advances in the development of neurotechnologies have the potential to revolutionize the treatment of brain conditions. However, a critical concern revolves around the willingness of the public—those who stand to be direct (potential end-users) and indirect (family members, a well as society at large) beneficiaries—to embrace these innovations, especially considering the tumultuous histories of certain brain-based interventions. Consequently, examining public attitudes is paramount to uncovering potential barriers to adoption.

Methods: In the present study, we investigated public attitudes toward the use of four neurotechnologies (within-subjects conditions): deep brain stimulation (DBS), transcranial magnetic stimulation (TMS), pills, and MRI-guided focused ultrasound (MRgFUS) as potential treatments to a person experiencing either mood, memory, or motor symptoms (between-subjects conditions). United States participants ($N = 1052$; nationally representative based on sex, race, age) were asked about their perceptions of risk, benefit, invasiveness, acceptability, perceived change to the person, and personal interest in using these neurotechnologies for symptom alleviation.

Public Attitudes Toward Using Polygenic Embryo Screening for Cognitive Disorders and Traits

Rémy Furrer[a], Dorit Barlevy[b], Stacey Pereira[b], Shai Carmi[c], Todd Lencz[d] and Gabriel Lázaro-Muñoz[a,e]

[a]Center for Bioethics, Harvard Medical School; [b]Center for Medical Ethics and Health Policy, Baylor College of Medicine; [c]Hebrew University of Jerusalem; [d]Donald and Barbara Zucker School of Medicine at Hofstra/Northwell; [e]MGH

Introduction: Polygenic embryo screening (PES) is an emerging biotechnology used - in the context of *in vitro* fertilization—to screen individual embryos for the chances of developing polygenic neuro-cognitive conditions (e.g., Alzheimer's disease) and traits (e.g., intelligence) in the future. This study surveyed the U.S. public's attitudes toward PES, exploring acceptance of, interest in, and potential uses and concerns of this novel biotechnology.

Methods: The sample comprising U.S. adult participants ($n = 1427$) was nationally representative based on gender, age, and race. We asked the public to rate their approval for using PES to screen embryos for several neurologically-based (or brain-based) conditions and traits.

Results: Reported in descending order of mean approval, the public expressed support for using PES to screen embryos for Alzheimer's disease, schizophrenia, bipolar disorder, autism, depression, OCD, ADHD, intelligence, and neuroticism. Alzheimer's disease received 77% approval (42% "strongly approve" and 35% "approve"), with only 14% of the public disapproving of screening and 9% neither approving

nor disapproving. Schizophrenia received the highest screening approval as a psychiatric health condition, with 77% of the public approving (40% "strongly approve" and 37% "approve"), 9% being ambivalent and only 14% disapproving. Screening for intelligence had 60% of the public either approving (37%) or being ambivalent (23%). While public approval is noticeably high, when asked to rate a list of potential concerns, 54–55% of respondents were "very" to "extremely concerned" about PES leading to false expectations, promoting eugenic practices, and increasing stigma around the conditions and traits perceived as less desirable.
Conclusion: Given that PES is already commercially available and has raised practical and ethical concerns among physicians, patients, geneticists, bioethicists, and lawyers, it is notable that there is such high public approval for the use of PES to screen embryos for neuro-cognitive conditions and traits. Understanding these attitudes is essential for informing policymakers, healthcare professionals, and researchers about the public's perspectives on this novel biotechnology.

Fracking the Brain: Ethical and Neurological Considerations of Unconventional Oil and Gas Development

Ava Grier and Judy Illes

University of British Columbia

Background: The early 2000s saw major advancements in the development of hydraulic fracking combined with horizontal drilling to access previously uneconomic reserves of natural gas and oil deep in shale formations. The implementation of this technique, also termed unconventional oil and gas development (UOGD) is controversial. It has provided jobs, enhanced US economy, and reduced coal emissions (Hassett and Mathur 2013) while concurrently posing many potential and documented health risks through the contamination of air and water in communities nearby (Hill and Ma 2022; Webb et al. 2018). It is unsurprising that this process, which involves injecting highly pressurized water, sand, and chemicals, deep into the earth's surface to fracture rock and free oil, brings forward concerns from environmental ethicists and experts in human health (Cabrera et al. 2016). It is understood that some of the by-products of UOGD are toxic to the nervous system (Webb et al. 2018), and that environmental injustices surrounding development of drilling waste sites have long been a problem faced by many communities (Johnston, Werder, and Sebastian 2016).
Methods: We conducted a content analysis of ethics discourse and inquiry in the published fracking literature using search terms for brain and mental health, environment, and ethics for the five-year period between 2016 and 2022.
Results: Eighty-four articles met inclusion criteria. Seventy-six percent (76%) mentioned impacts on brain (e.g., neural tube defects, neurological symptoms), and mental health (e.g., negative psychological effects, depression) briefly. Thirteen percent (13%) dedicated substantive discourse to either or both together. Safety (77%) was the most prominent ethics theme. Discussion of environmental injustices as fracking sites disproportionately affect vulnerable communities appeared in 38% of the papers.
Discussion: The consequences of human made environmental change on the brain and mental health are apparent in past studies and the present one. We examine our findings through the intersectional lens of environmental neuroethics (Webb et al. 2018) and argue that far greater interdisciplinary, intersectoral work than currently exists is warranted to accomplish a balance in the risk-gain UOGD ecosystem for human autonomy and wellness.

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What Does a Donor Need to Know? A Critical Look at Informed Consent Documents for Brain Organoid Research

Zoë JoEllen Hale[a], Abril Beretta[b], Chloe Dahleen[a], Esha Patel[a] and Kate MacDuffie[b,c]

[a]University of Washington; [b]Treuman Katz Center for Pediatric Bioethics and Palliative Care, Seattle Children's Research Institute; [c]University of Washington School of Medicine

Brain organoids—neural tissue cultivated from donor biospecimens (e.g., blood, skin samples)—are increasingly being used for research on

neurodevelopmental and neurodegenerative conditions (Trujillo and Muotri 2018). But donors of cells used to create brain organoids (BOs) may not understand what brain organoids are, how their cells will be used, or the long-term implications of the research (MacDuffie et al. 2023). The goal of this project was to critically evaluate informed consent documents used for BO research. We used the Dickert et al. functions of informed consent framework (Dickert et al. 2017) to guide our analysis with a focus on three functions: transparency, promotion of welfare, and concordance with values. Specifically, we asked: What information is shared in informed consent documents for brain organoid research and does it fulfil these three functions?

Consent documents were collected from brain organoid research teams and blindly coded by 2–3 coders using ATLAS.ti software. Research teams were identified through PubMed and NIH RePORTER database searches and snowball recruitment.

Initial analyses of 20 consent documents revealed the amount of detail provided in consent forms was highly variable; some documents included an overwhelming amount of educational background information and detailed study procedures, others provided little to none. None of the consent documents contained the term "brain organoid." The one document that provided the closest description of brain organoid generation stated: "The cells…will undergo a specific procedure…that enables the generation of neuronal and glial brain cells." 14/20 documents provided broad and vague future use statements, primarily regarding the creation and sharing of cultured cell lines. The most specific future use statement in a single document detailed potential use of biospecimens for research, patient care, genetic modification of the cells, or animal experimentation.

These preliminary results suggest a notable lack of transparency in current informed consent documents for brain organoid research. This is particularly concerning given the ethical sensitivity of brain organoid research (de Jongh et al. 2022), as participants cannot reflect upon the ethical considerations of research they do not know they are a part of. The variability of information presented in consent forms creates a barrier within the informed consent process; few documents provided specific options for values-based decision making regarding biospecimen use. However, these early findings show most of these documents fulfil several other functions of informed consent outlined by Dickert et al. (Dickert et al. 2017), namely adherence to regulatory requirements and promoting integrity of research and researchers. That said, it is important to acknowledge that providing prospective participants with exhaustive detail meant to promote transparency and trust could be overwhelming, hindering their ability to make meaningful decisions or compromising the other functions of informed consent (Dickert et al. 2017). Future work is needed to determine how to present information that is clear, comprehensive, and digestible by the target audience, while placing respect (Wilfond et al. 2017) for potential biospecimen donors at the forefront in the informed consent document process.

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"If There Were More Resources we Could Have Done More": Investigator Perspectives on Post-Trial Responsibilities in Neural Implant Trials

Nathan Higgins[a], John Gardner[b] and Adrian Carter[a,b]

[a]School of Psychological Sciences, Monash University; [b]School of Social Sciences, Monash University

Clinical trials of neural implants are growing and diversifying. Established device platforms, such as DBS, continue to be explored for psychiatric illnesses, and a new generation of pre-commercial BCIs are transitioning from feasibility testing to multi-center trials. These trials are expensive, involve significant risks, and recruit only the most treatment-refractory patients able to meet study demands. These factors raise ethical concerns during trial exit, such as whether participants will have the option of keeping their implant, whether they will receive specialist care, and to what extent this ongoing support will be at their own personal expense. Several recent studies have found that many participants remain implanted and continue to receive care, however little is known about the pragmatic decisions and ad hoc negotiating tactics that are necessary for the facilitation of continued

access. The present study examined the experiences and perspectives of neural implant investigators in managing post-trial responsibilities. In-depth, semi-structured interviews were conducted with 21 trial investigators. Investigators worked in psychiatry, neurology, neurosurgery, and bioengineering, with a mean of 16.5 years experience with implantable neurotechnologies. Just over half had worked on pivotal trials of DBS, although many had worked on early feasibility studies of sensory neuroprostheses or intracortical brain-computer interfaces. We identified key themes related to the descriptive and normative elements of continuing trial responsibilities. Some investigators described post-trial care as routine, owing to close relationships with device manufacturers and supportive research institutes. Others struggled to sustain funding, were left caring for participants following manufacturer abandonment, or scrambled to replace essential research staff when they retired or moved. All nevertheless reflected on a strong sense of personal responsibility to ensure that participants continued to receive care, albeit acknowledging the competitive realities of the neurotechnology funding and translation ecosystem. By continuing to characterize trial features that either streamline or frustrate the provision of post-trial care, investigators will be better equipped to anticipate and overcome barriers. In the pursuit of practical ethical guidelines, it is imperative that these efforts do not neglect to engage other stakeholder groups, such as research institutions, oversight bodies, and device manufacturers.

Always-On DBS and Portable MRI Evidence in the Courtroom: Preventing Misuse and Promoting Justice

Sam Holloway[a], Ian Stevens[b,c], Robert Kim[d], Craig McFarland[e], Key Williams[e], Ithika Senthilnathan[f], Peter Zuk[g], Gabriel Lazaro-Munoz[c,g] and Francis X. Shen[a,c,g]

[a]Harvard Law School; [b]Oregon Health & Science University; [c]Harvard Medical School; [d]University of Maryland; [e]Harvard College; [f]Duke University; [g]Massachusetts General Hospital Department of Psychiatry

Background & problem: The past two decades have seen many legal cases and significant neurolaw scholarship concerning the admissibility of neuroscientific evidence in courtrooms (Jones, Schall, and Shen 2022; Moriarty 2021). Yet neither practice nor scholarship have accounted for the legal use of two new neurotechnologies: (A) minute-by-minute evidence derived from "always-on" deep-brain neurostimulators (Zuk et al. 2020); and (B) evidence from newly FDA cleared low-field (LF) MRI scanners (Kimberly et al. 2023). Analysis of the courtroom admissibility of this new neurotech evidence is urgently needed to ensure that the legal system makes scientifically sound decisions.

Research questions and methods: Adopting a framework recently proposed by the Committee on Emerging Science, Technology, and Innovation (CESTI) at the National Academies (Mathews, Balatbat, and Dzau 2022), we develop two realistic legal uses cases:

- First: prosecutors or criminal defendants using continuous recording data from an implanted DBS to prove/disprove that the defendant possessed the requisite mental state at the time of the alleged crime; and
- Second: use of portable MRI in prisons to conduct serial neuroimaging of incarcerated individuals to provide additional evidence for those individuals' claims of civil rights violations by prison staff.

Conclusions & importance: *If* properly evaluated, this new brain evidence could be admissible and improve legal outcomes. There are two distinguishing features: (Moriarty 2021) brain data will be measured while humans are in real-life environments beyond the lab, and (Jones, Schall, and Shen 2022) brain data will be measured at multiple time points, allowing for comparisons over time. On one hand, these features improve the legal relevance of the brain data. On the other hand, they introduce significant noise into data quality. These features improve the legal relevance of the brain data, but also introduce significant noise into data quality. We lay out framework by which courts could properly evaluate the admissibility of the evidence.

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Demystifying the Risk of Reidentification in Neuroimaging Data – A Technical and Regulatory Analysis

Anita S. Jwa, Oluwasanmi Koyejo and Russell A. Poldrack

Stanford University

Data sharing has been widely promoted in the field of neuroimaging and has enhanced the rigor and reproducibility of neuroimaging studies (Poldrack and Gorgolewski 2014). Yet the emergence of novel software tools, such as face recognition, has raised concerns due to their potential to reidentify neuroimaging data that are thought to have been deidentified (Eke et al. 2021). Despite the surge of privacy concerns, however, the risk of reidentification via these tools has not yet been examined outside the limited settings for demonstration purposes. In this study, we examined the likelihood of reidentification via face recognition in real-world settings and analyzed its regulatory implications.

According to Schwarz et al. (2021), the matching rate of facial images reconstructed from defaced MRI scans (using pydeface; Gulban et al. 2019) with subject photos was 10% ($N = 157$) (Schwarz et al. 2021). On previously defaced images where the facial structure was imputed using an average template ("refaced images"), the matching rate increased to 38% (Schwarz et al. 2021). To test the generalizability of these reported accuracies, we designed a classification problem using simplified data. Test data are generated from a normal distribution by adding random noise to each individual calibrated to provide two target levels of reidentification performance (10 and 38%). We then assessed reidentification performance for that level of signal-to-noise as the population size varied from 157 to a size large enough to be realistic by taking the example of the Pittsburgh, Pennsylvania, metropolitan area—6,500 (a Black female, age 25–29), 70,000 (a female age, 25–29), 423,000 (a female age, 20–49), and 865,000 (an adult, age 20–49) (Figure 1)(Jwa, Koyejo, and Poldrack 2024). For the higher signal-noise simulation (matching subjects' photos with refaced structural MR images), identification accuracy dropped from 37.6% for the initial population size of 157 to 8.6% at a population size of 6,500; to 2.4% at 70,000; to 0.9% at 423,000; and to 0.6% at 865,000 (Jwa, Koyejo, and Poldrack 2024). For the lower signal-noise simulation (matching subjects' photos with defaced structural MR images), identification accuracy dropped from 9.6% at the initial population size of 157 to 0.8% at a population size of 6,500; to 0.2% at 70,000; to 0.05 % at 423,000; and to 0.03% at 865,000 (Jwa, Koyejo, and Poldrack 2024). The relationship between accuracy and population size is roughly linear in log-log space, consistent with theoretical results.

Our regulatory analysis further suggests that defaced neuroimaging data would still meet the requirements for data deidentification under the current US regulatory regime. Given the low likelihood of real-world reidentification, applying a face recognition algorithm would not make the identity of data subjects readily ascertainable under the Common Rule. It is also unlikely that this risk would affect achieving data deidentification under the HIPAA's two standards—expert determination and safe harbor methods. Yet considering that regulatory requirements only provide minimally necessary protection, we suggest implementing more proactive privacy measures, such as tiered control of access to shared neuroimaging data.

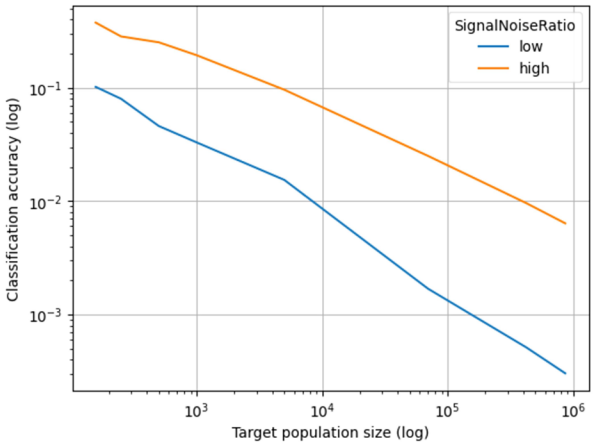

Figure 1. Classification accuracy as a function of the target population, from 157 (the population size used by Schwarz et al. (2021) to 865,000. Results are presented on a log-log scale to allow better visualization of small accuracy values.

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More Hydra, than Human? Ethical Implications of Information Flows in Human Brain Organoids

J. Lomax Boyd

Berman Institute of Bioethics, Johns Hopkins University

Brain organoids—whether of human origin, or otherwise—may eventually possess neural networks that support morally-relevant dimensions of cognition. The lack of behavioral responses from brain organoids confounds standard approaches toward assessing the capacity of these entities to display interests, preferences, or consciousness. Some propose that the presence of neural structures associated with valence could inform welfare concerns (Browning and Veit 2023). This similarity-based approach seems most useful for "whole-brain" organoids or those that aim to model affect-associated neural structures found in neurotypical members of the donor species. However, the neural organization of organoids is incredibly varied (Diner 2023). The 3D architecture of human brain organoids (HBOs) exhibit highly disordered laminar organization that deviates significantly from species-typical anatomies (Revah et al. 2022). Furthermore, we currently lack a clear theoretical framework for assessing broader classes of morally-relevant cognitive capacities that HBOs neural networks could acquire. These limitations become more salient in the context of synthetic biological or organoid intelligence where HBOs are integrated with artificial intelligence systems that lack biological components (Kagan et al. 2024; Smirnova et al. 2023). I argue that a theory of cognitive evolution can guide the development of an approach based on information flow or computational architecture, without commitments to species-specific neuroanatomia (Boyd 2024). Here, the evolution of neural systems can be grouped into major transitions that represent fundamental changes in information representation (Barron, Halina, Klein 2023). How information flows within a neural system is crucial to the emergence of broad cognitive capacities that are relevant to ethical consideration. For instance, the distributed neural net of hydras are capable of habituation, while the evolution of recurrent loops in insects enabled error prediction motifs to support forward modeling capabilities that can contribute to an evaluative stance, a trait unrealizable in distributed architectures. Information flow in human brains is highly parallelized and multiplexed. The same information can be processed for many uses, including valenced representations, and the structure of information flow itself can be explicitly controlled in ways that are less computational achievable in distributed or recurrent architectures. HBOs with localized, unidirectional network motifs would have cognitive capabilities more akin to a hydra than human. The information flow approach provides an experimental neuroethics framework for determining whether HBOs, and other novel biological-hybrid entities, possess the kind of neural configurations that support moral status-conferring attributes.

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Risk Factors and Ethical Considerations for Developing and Commercializing Neurotechnologies: Findings from Interviews with Institutional Officials

Tristan McIntosh, Meredith Parsons, Erin Solomon and Maya Skolnik

Bioethics Research Center, Washington University School of Medicine

Collaboration between industry and academic institutions in the research, development, and commercialization of neurotechnologies is needed to offset the limitations in resources and expertise of each sector alone. However, there can be conflicting interests, values, and priorities between and within these sectors. For example, academic interests have grown to include innovation and entrepreneurship, along with maintaining institutional reputation and minimizing institutional risk (Abreu et al. 2016). Despite good intentions, the risk of unconscious bias, individual and institutional conflicts of interest (COIs), and other ethical considerations may shape decision-making of

researchers, academic institutional officials, and industry partners that allow secondary interests (e.g., financial or professional gain) to supersede interests of high importance to research and clinical communities (e.g., objectivity and transparency of research; patient safety, autonomy, and privacy) (Association of American Medical Colleges 2007; Dana and Loewenstein 2003). To ensure patient and research participant protection and rigor of neurotechnology research, these risk factors need to be better understood and addressed, especially given rapid developments in neurotechnology research and limitations of existing research regulations (Eaton and Illes 2007).

As part of a larger NIH BRAIN Initiative-funded research effort examining practical and ethical concerns and risk factors that emerge with industry-academia neurotechnology partnerships, we conducted in-depth interviews with 30 academic institutional officials: 15 regulatory and compliance professionals, and 15 partnership cultivation and technology transfer professionals. Participants were asked about ethical considerations, policies, and regulations surrounding partnerships with the neurotechnology industry that affect research activities (e.g., design, conduct, reporting, and translation of neurotechnology research). Participants were also asked their perspectives on how to best balance conflicting priorities and address unconscious bias. Audio-recorded interviews were transcribed and rigorously coded by the research team.

We will present results with important ethical and practical considerations for the neurotechnology industry, academic institutions, and researchers as new partnerships are established and decisions need to be made that affect patients and scientific research. This includes decision-making priorities relating to intellectual property rights, COI policies, and managing biases with potential to unduly affect neurotechnology research. Findings also provide industry and academic stakeholders with practical strategies for being responsible innovators and preparing and informing patients about various risks and expectations associated with new neurotechnologies (OECD 2021).

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Agency and Vulnerability: The Dual-Aspects of Psychedelic-Facilitated Neuroplasticity

Logan Neitzke-Spruill

Center for Medical Ethics and Health Policy, Baylor College of Medicine

Psychedelic drugs have again become the subject of numerous scientific and scholarly investigations with much attention given to the drugs' potential as treatments for an array of mental health conditions. As the pursuit of mechanisms to explain the subjective and therapeutic phenomena psychedelics facilitate has become a unifying problem in the field, the influence of neuroscientific techniques has meant that brain-based explanations have taken precedent. Specifically, neuroplasticity—the concept referring to our brains' ability functionally and structurally reorganize neuronal and neural network connections—has been adopted as a catch-all neurobiological explanation for psychedelics' effects owing to an array of animal models and neuroimaging studies. Thus far, most of the bio/neuroethical literature about psychedelics has focused on issues of moral-enhancement (Langlitz et al. 2021), informed-consent (Smith and Sisti 2021), the vital-importance of the subjective to therapeutic outcomes (Peterson and Sisti 2022; Yaden and Griffiths 2021), diversity and inclusion (Thrul and Garcia-Romeu 2021; Williams and Labate 2019), respect and reciprocity for indigenous culture (Celidwen et al. 2023; Fotiou 2019), as well as additional safety concerns (Anderson, Danforth, and Grob 2020). The aim of this presentation is to explore the neuroethical issues stemming from psychedelics' apparent neuroplastic effects, as well as the implications of leveraging psychedelics' plasticity-generating effects in clinical contexts.

First, I highlight the significance of neuroplasticity as a phenomenon due to its function as a mechanism for experience to shape the formation of neural and neuronal connections. I proceed by drawing attention to competing theoretical interpretations of neuroplasticity that tend to view concept as a marker of freedom or determinism. Whereas some emphasize that neuroplasticity enables people to freely develop in diverse ways, others emphasize that neuroplasticity leaves us vulnerable to a variety of determinisms (e.g. biological, social). I argue that neuroplasticity simultaneously potentiates agency and vulnerability by virtue of its function as mechanism for interactions to shape and reshape neural connections.

Next, I outline what I call the dual-aspects of neuroplasticity—agency and vulnerability—as well as the accompanying ethical issues pertain to psychedelics' capacity to facilitate self and brain changes. Agency is something that is exercised and achieved in concert with one's social environment. I review findings which suggest psychedelics can facilitate heightened states of neuroplasticity in the brain, which correspond to phenomenological effects that can both promote self-directed agency and leave individuals more vulnerable to various exposures. For example,

psychedelics oftentimes produce the sorts of reflexive thought and deliberation that can be conducive future oriented action and decision making, although self-changes may ultimately be constrained by the social-environment. Conversely, vulnerability refers to the various needs, exposures, and dependencies inherent to the human condition (Mackenszie 2014), which often stem from mutual dependencies arising from sociality and susceptibility to the influence of others in the process of self-formation and neurodevelopment. Regarding psychedelics, facilitating heightened states of neuroplasticity in therapeutic contexts may leave patients more vulnerable to harms inadvertently or maliciously caused by their caretakers.

Ultimately, I raise several ethical questions surrounding the dual-aspects of psychedelic-facilitated neuroplasticity. I conclude by arguing that ethically administering psychedelics in clinical and research settings requires a commitment to maximizing participants to capacity enact transformative agency.

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Improving Bi-Directional Learning, Engagement, and Recruitment in Human Neuroimaging Research

Helen Hemley[a], Susie Y. Huang[b,c], Jonathan D. Jackson[a,c] and Francis X. Shen[d,e]

[a]CRESCENT Advising, LLC; [b]MGH Martinos Center; [c]Harvard Medical School; [d]University of Minnesota Law School; [e]MGH Center for Law, Brain & Behavior

Background: The Need for More Representative and Diverse Participants in Human Neuroimaging Research. Much human neuroimaging research continues to rely on non-representative convenience samples, undermining many key assumptions supporting causal inference in research. A significant barrier to bidirectional learning is conflation of engagement and recruitment. Engagement centers on improving research literacy and interest. Recruitment focuses on individual research studies. (Birms et al. 2008; Clark et al. 2019; Ricard et al. 2023) Human neuroscience research does not reflect the racial, ethnic, geographic, and socioeconomic diversity of the population. (Jones et al. 2020; Sterling et al. 2022)

Problem: New Tools & Approaches Needed for Neuroimaging Researchers to Engage Underrepresented Communities. Insufficient ethical guidance & tools for neuroimaging researchers on conducting community-engaged research with underrepresented and minoritized (URM) populations. (Shen et al. 2024) Pursuit of more diverse participant pools requires careful consideration about how diversity and population descriptors (e.g. for race, ethnicity, gender) should be defined (Cardenas-Iniguez and Gonzalez 2024).

Research questions and methods: Supported by an NIH BRAIN grant (7R01MH134144-02), Improving Recruitment, Engagement, and Access for Community Health Equity for BRAIN Next-Generation Human Neuroimaging Research and Beyond (REACH for BRAIN) directly addresses the need for deeper community engagement and more representative participation in neuroimaging research. REACH for BRAIN will implement strategies developed by Hemley et al (in press) (Hemley et al.; Ison, Jackson, and Hemley 2021). A stakeholder network comprised of 12 Black and Latinx community leaders across Boston will co-develop a targeted, community-led and participant-centered sampling, engagement, and recruitment framework for neuroimaging researchers to reach motivated participants from URM communities, including selection metrics and catchment modeling; a Theory of Change (ToC) process and a detailed roadmap and evaluation plan for inclusive recruitment for research; (Taplin et al.

2013) and co-created events, Community Engagement Studios, and touchpoints in the community to facilitate bi-directional learning. Initial Implementation will be with Connectome 2.0 scanner research. Connectome 2.0 is a next-generation human connectomics scanner optimized for study of neural tissue microstructure and neural circuits across multiple length scales (Huang et al. 2021).

Conclusions: We report on preliminary findings based on initial implementation of this novel strategy. We report on both successful outcomes and challenges in co-creating a sampling, engagement, and recruitment framework for neuroimaging researchers to reach motivated participants from URM communities. We also share lessons on how to navigate associated neuroethics challenges such as informed consent, therapeutic misconception and distrust in research.

Preliminary work & next steps: The stakeholder network is being built, and the neuroethics and neuroimaging teams are meeting to build protocols. Next steps in the project are to convene the stakeholder network, refine the ToC, and expand engagement work through events.

Importance: This project offers the research community new strategies for addressing the long-standing challenge of improving engagement and recruitment of URM communities in neuroscience research.

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Human Supremacy in Neuroethical Discourse About Human-Nonhuman Neural Chimeras

L. Syd and M. Johnson

Upstate Medical University

The ethical and societal implications of the brain sciences are the domain of neuroethics, but neuroethics has paid little attention to those implications for the many species of animals used in neuroscientific research. While the emergence and development of neuroethics as an interdisciplinary field coincided with the rapid growth of knowledge about animal brains, minds, intelligence, culture, behaviors, and capacities, that knowledge has not been integrated into neuroethics to a notable degree despite the centrality of the brain to all these features of animals and their lives. That rich body of research and thought has similarly had little impact on animal research practices and regulations. Neuroethics is in a position to lead in deliberations concerning the implications of our understanding of the minds of other animals for neuroscientific research, the moral status of these animals, and our moral obligations to them.

This presentation argues for more intellectual and ethical rigor in neuroethics, and calls for it to confront the anthropocentric speciesism and human exceptionalism that have dominated its discussions of the use of animals in neuroscientific research, especially the overexamined problem of "humanizing" chimeric animals. Attention to this problem has collapsed into anthropocentric speciesism and human exceptionalism while overlooking the morally relevant

human-like traits and capacities of animals. What is neglected in the discussion of humanizing chimeras is the likelihood that many species already possess the characteristics that effectively "humanize" them. That is, they already share with humans the kinds of capacities and traits that make humans purportedly unique entities of moral concern. Psychological, emotional, and social complexity, culture and the use of language and tools, consciousness, intelligence, problem-solving, autonomy, moral agency, and even concepts of and rituals associated with death are found in numerous species. Importantly, any morally valued trait found in humans is not found in all humans, and is not found only in humans. A neuroethics that takes seriously the role of the mind and brain in shaping identity, values, and moral considerability must thus move beyond mere anthropocentric speciesism and human exceptionalism in thinking about the implications of creating human-nonhuman chimeras.

The Right to Be Recognized? A Neuroethics Case Study on the Risks and Harms of Qualitative Data De-Identification Norms

Erika Versalovic[a], Asad Beck[a], Sara Goering[a] and Timothy E. Brown[b]

[a]University of Washington; [b]University of Washington School of Medicine

Qualitative research can be a key mode of gathering research participant perspectives in neuroscience. Further, the ability to center diverse participant voices is particularly important in order to identify systemic barriers, address historical harms, and work toward a more equitable and just field (Rollins 2021; Shen 2020).

However, sharing participant stories as collected in interviews can be tricky. The identity and contextual details critical to who participants are and what they wish to communicate can be the same details flagged for redaction to meet data protection and anonymization norms (Kaiser 2009). To meet an anonymization standard, a Black male interviewee may have his complex intersectional identity and lived experience shorthanded to a "a non-white participant" with "experience of racial discrimination." If the study contains very few non-white participants, even that may not be sufficient. In aiming to protect participants, such norms may in effect "whitewash" their testimonies.

These issues arose in a recent neuroethics project on the prospect of deep brain stimulation for substance use disorders (Versalovic, Beck, and Brown 2023). The social stigma surrounding SUDs and racist histories of criminalization increased the importance of including racially diverse perspectives. Yet publishing requirements to protect participants from identification risk meant redacting key contextual details. In the name of rigorous data anonymization standards, participants were rendered invisible within their own narratives (Versalovic et al. 2023).

Using this project as a case study, we problematize these anonymization norms in four ways: (1) they may not be effective in anonymizing data; (2) they can undermine participant agency; (3) they can conflict with justice aims; (4) these norms can inequitably impact the marginalized and oppressed.

We suggest shifting away from asking how to protect participants and their data and toward asking how we can respect and empower participants. Strategies include the use of a more nuanced, ongoing informed consent process and building in interview questions on participant data protection and sharing preferences. Close attention to participant narratives is integral to respecting participant agency within studies and building more just research paradigms.

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