



BRAIN 2025
(Brain Research through
Advancing Innovative Neurotechnologies)

envisioned the need for Neuroethics

FIRST FIVE YEARS

SECOND FIVE YEARS

Emphasize
technology
development

Emphasize
discovery
driven science

The authors noted:

“Although brain research entails ethical issues that are common to other areas of biomedical science, it entails special ethical considerations as well. Because the brain gives rise to consciousness, our innermost thoughts and our most basic human needs, mechanistic studies of the brain have already resulted in new social and ethical questions.”

CHARGE

- Develop an NIH BRAIN Initiative **Neuroethics Roadmap** for the NIH BRAIN Initiative
- Review the priority areas in BRAIN 2025 (incorporating updates from the broader WG 2.0) and characterize the neuroethical implications that may arise:
 - as BRAIN Initiative investments produce new tools and neurotechnologies, and/or
 - those tools and neurotechnologies are applied toward advancing the goals of the NIH BRAIN Initiative

James Eberwine (Co-Chair), University of Pennsylvania^{+#} - Genomics

Jeffrey Kahn (Co-Chair), Johns Hopkins University - Ethics

Adrienne Fairhall, University of Washington* - Computational Biology

Christine Grady, NIH*+ - Ethics

Elizabeth Hillman, Columbia University* - Bioengineering

Insoo Hyun, Case Western University – Ethics

Andre Machado, Cleveland Clinic - Neurosurgery

Laura Roberts, Stanford University – Psychiatry

Karen Rommelfanger, Emory University⁺ - Ethics

Francis Shen, University of Minnesota - Law

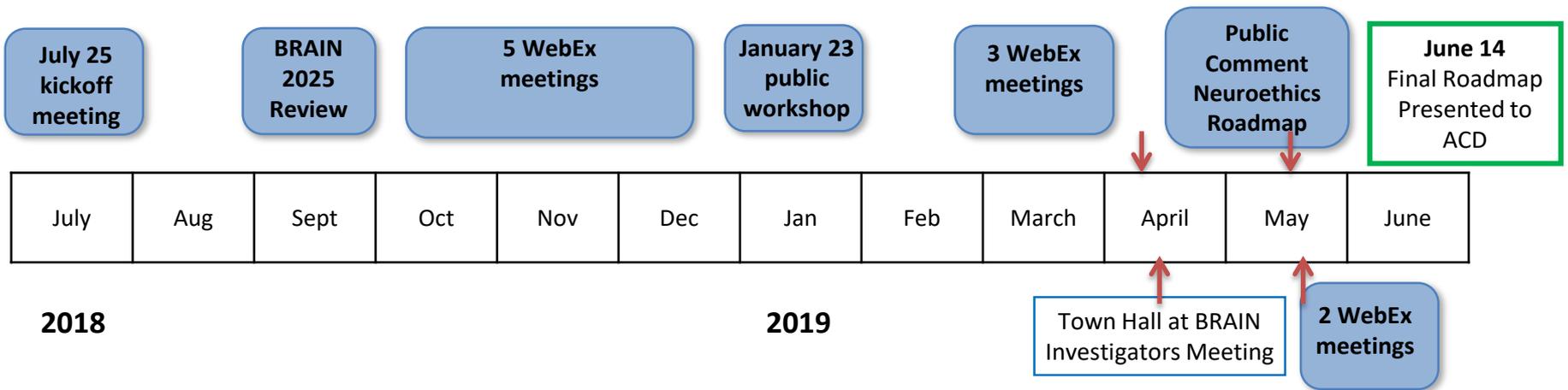
* ACD BRAIN WG 2.0 member, # BRAIN Multi-Council Working Group

+ BRAIN Multi-Council Working Group Neuroethics Working Group

Executive Secretary: Ellen Gadbois (NIH Office of Science Policy)

Science Writer: Alison Davis (NIH Consultant)

TIMELINE



WORKSHOP January 23, 2019

Mapping the Global Landscape of Neuroethics: *Caroline Montojo, PhD - The Kavli Foundation*

Responsible Brain Research and Neuroethics: the Case of the Human Brain Project

Arleen Salles, PhD - Uppsala University

Ethics of the Use of Non-Human Primates as Models for Human Brain Disease

Jeffrey Kahn, PhD (BNS member)

Ethics and Innovation in Neuroscience and Psychiatry: Stakeholder Perspectives

Laura B. Dunn, MD - Stanford University

Ethical Considerations for Human Organoid Research

Insoo Hyun, PhD (BNS member)

Does Existing Guidance Suffice for BRAIN Research?

Christine Grady, MSN, PhD (BNS member)

What Can We Learn from DBS? *Ethical considerations in innovative neural devices*

Karen S. Rommelfanger, PhD (BNS member)

BRAIN 2025 and the Future of Neurolaw

Francis X. Shen, PhD, JD (BNS member)

The Brain Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society

1. Neuroethics Past, Present and Future
2. Studying Ourselves: The Uniqueness of Neuroscience
3. Neuroethical Implications of Neurotechnologies
4. Neuroethics and Research with Animal Models
5. Beyond the Bench: Real-World Translation of Neuroscience Research
6. Integrating Neuroethics and Neuroscience

Transformative Project: Revolutionizing BRAIN

Understanding the Bases of Consciousness: Intersection of Neuroscience and Neuroethics

Opportunities for Public Input

- Interviewed Neuroethicists
- Hosted Public Workshop on January 23
- Sought Comments by Presentation to:
 - Town Hall at BRAIN Investigators Annual Meeting
 - American Academy of Neurology Annual Meeting
 - Multi-Council Working Group Meeting
- Posted Early Draft for Comment: May 1 – 20
 - Flagged for experts, including the Multi-Council Working Group and the NIH BRAIN Neuroethics Working Group

Selected Public Comments from 19 Total

Multiple Signatories – We would like to thank the committee for a thoughtful review and analysis of current and future priorities....

- We focus on the need to study secondary applications of emerging neurotechnologies
- The importance of enhancing the representation of underrepresented groups both as researchers and participants in science and neuroethics
- We commend the BNS for proposing an increase in funding for Neuroethics research

5 Signatories - The proposed improvements in institutional capacity for neuroethics in Chapter 6 will be vital to address the dearth of funding mechanisms, training programs, faculty positions, and other infrastructure in neuroethics. We would also like to advocate for -

- A greater emphasis on the Neuroethics Subgroup's goal of public engagement, specifically for the purpose of incorporating public values when mapping the priorities of neuroethics research.

Foundation - Very wide-ranging and thorough... sending my compliments to the subgroup.

- Would be helped by greater effort to include the public in the research process

46 Signatories - We are pleased to see that research on consciousness is receiving recognition.

- Concern about inclusiveness in potential implementation

Researcher - In particular, the importance of taking culture into account in neuroethics research was mentioned in several instances. I applaud this emphasis. Should also emphasize

- International coordination of research funding,
- International coordination of regulatory oversight to mitigate the risk of ethics evasion.

Multiple Signatories - Thanks so much for the great work on the NIH Neuroethics Roadmap.

- We recommend funding strategies that directly support the institutional infrastructure needed to have multi-level training and mentoring.
- Our point is that “inclusion of an ethics perspective” can be done relatively superficially, or in a much more integrated and robust way, and our aim with this recommendation is to aim for the latter, rather than the former
- We would recommend that the NIH recognize the need for funding more than empirical neuroethics
- The Roadmap notes the need for more attention to the meaning of terms such as agency, empathy, free will, and consciousness
- As the Roadmap identifies, non-human primates or other animals that are “humanized” to provide better models of disease or function, ... We agree that more attention needs to be paid to these issues,

>**300 Signatories** - We focus specifically on “Neuroethics and Research with Animals”.

- This chapter seems to us both to overreach any reasonable scope of action for the BNS
- offers a set of highly questionable principles for the conduct of neuroscience research with animals, especially nonhuman primates. We ask that it be deleted in its entirety from the Roadmap. ...
- None of the work discussed raises ethical questions that are either new or unique, and little of the material in the chapter is particular to the BRAIN Initiative.
- They have no place in a neuroethics document specific to the BRAIN Initiative, which does not include most of the key stakeholders. The overreach is most egregious in the chapter’s particular focus on work with non-human primates (NHPs), which is a relatively small part of the BRAIN Initiative.
- On this questionable basis, the document proposes to set frameworks, establish principles, and make rules for a large research community, most of which has no connection to the BRAIN initiative.

Researcher - I was happy to see a chapter of the Roadmap dedicated to Neuroethics and Research with Animals.

- I'd like to see more detailed information on the expected contribution of neuroethicists to the four priority areas that the BNS has in mind. What, specifically, is deficient about existing frameworks and analyses?
- I was happy to read the suggestion for registration and more frequent reporting of BRAIN Initiative-funded studies involving non-human primates. Transparency is a key aspect of trustworthy research.

ACD WG –

- concern about characterization of organoids attaining human characteristics,
- concern about inclusion of neuroethicists in research projects (*dealt with early on*)
- more discussion of equity in neuroscience research
- concern about use of the phrase “nonhuman animal”
- concern about the Chapter on animal research, paying too much attention to NHP.

Multi-Council Working Group –

- concerned about the use of the word “humanized” to describe research with genetically modified NHP
- concerned about data sharing for incomplete NHP work
- ethical issues with NHP same as for use in cancer or immunology so shouldn’t be highlighted for BRAIN research
- is extra justification for use of NHP in BRAIN research necessary?
- Concern about confusion in using the phrase “Theory of the Mind” in the Transformative project.

1. Neuroethics Past, Present and Future

- Neuroscience research entails ethical issues common to other areas of biomedical science and conveys unique considerations
- From its beginning, the BRAIN Initiative highlighted the importance of neuroethics
- Role of neuroethics in the BRAIN Initiative
 - What it is and why it's important
 - The need for neuroethics research
- Analyses and guiding principles identified by a range of groups
- Neuroethics Questions for Neuroscientists
- Neuroethics integral to the BRAIN Initiative

2. Studying Ourselves: The Uniqueness of Neuroscience

- Moral significance of the brain, approaches to neuroscience, and key assumptions underlying beliefs about the brain & modern neuroscience
- Implementable goals
 - Diversity of individuals & populations in research on human brains and functions
 - Examination & clarification of concepts--consciousness, empathy, and free will
 - An integrated approach to explore how assumed meanings and socially constructed identities influence study design and interpretation of results
- Ethical frameworks to guide “moonshot” aspects of the BRAIN Initiative
 - What ethics framework is needed at the level of large, government-coordinated scientific initiatives?

3. Neuroethical Implications of Neurotechnologies

- Uses BRAIN scientific Priority Areas to identify neuroethics issues/research opportunities
- Discovering Diversity
 - What features of engineered neural circuitry generate concerns about moral significance?
- Maps at Multiple Scales
 - How can human brain data and the privacy of participants be protected in case of immediate or legacy use?
- Brain in Action
 - Anticipatory approach exploring existing ethical and legal guidelines with diverse stakeholders
- Demonstrating Causality
 - Distinctions between therapy and cognitive enhancement; does neuroscience raise unique concerns?
- Identifying Fundamental Principles
 - Research on best practices for neuroethics research, data collection, and public engagement
- Human Neuroscience
 - Risks, benefits, and consequences of implantation of experimental devices that alter brain activity in healthy individuals
 - Informed consent processes for neurosurgical patients for research associated with, but not necessary for, medical care

4. Neuroethics and Research with Animal Models

- Underscores the value and need for neuroscience research with animal models in support of human health
- Neuroscience research with animal models does and will raise important ethics questions that deserve attention
 - Ethics analysis and guidance for research involving the insertion of human genes or the mimicking of human brain diseases and disorders in animal models
 - Evaluate existing frameworks and related criteria when using animal models and in novel neuroscience research models that approximate human brain function
 - Encouraging and facilitating global cooperation with other international brain-research initiatives is consistent with both efficient and responsible use and stewardship of NHPs
 - Encouraging enhanced data sharing among animal researchers, reflecting responsible stewardship

5. Beyond the Bench: Real-World Translation of Neuroscience Research

- The implications of BRAIN Initiative research stretch beyond traditional clinical and research contexts
- Consider progress to date and the need for greater attention regarding unresolved questions of accountability and potential regulatory gaps beyond the bench
 - Brain privacy
 - Neural data collection
 - Brain enhancement
 - Dual-use
 - Neuroscience and law
 - Neuroscience and education
 - Neuromarketing

6. Integrating Neuroethics and Neuroscience

- Suggest concrete steps for integrating neuroethics into the study and practice of current and future neuroscience research
 - Integrating neuroethics into the life cycle of a neuroscience research project
 - Dedicated support for neuroethics research, scholarship, and training
 - Career development, investigator-initiated, centers of excellence, etc.
 - Increasing annual funding from 1.8% to 5% of BRAIN annual budget
 - Global dialogue
 - Engaging the public

TRANSFORMATIVE PROJECT

Revolutionizing BRAIN

Understanding the Bases of Consciousness: Intersection of Neuroscience and Neuroethics

Understanding consciousness as a point of study for how brain activity elicits causality at a systems level in a human is a bold moonshot. These higher-order properties have been the focus of extensive philosophical and neurobiological inquiry. The goal of this transformative research project is to explore to what extent a functional or operational definition of the emergent phenomena, like consciousness, can best be explored in the laboratory and in the process developing neuroethics and neuroscience tools to determine criteria for defining and understanding consciousness.