

## Brain Research through Advancing Innovative Neurotechnologies® (BRAIN)

### Multi-Council Working Group Meeting

February 15, 2017

On February 15<sup>th</sup>, the [Multi-Council Working Group](#) (MCWG) for the National Institutes of Health (NIH) Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative® held its sixth in-person meeting at the NIH Porter Neuroscience Research Center in Bethesda, MD. The MCWG is an external group of scientific experts who provide oversight of the long-term scientific vision of the Initiative at NIH. The group met with directors and staff from the 10 NIH Institutes and Centers supporting the Initiative; individuals from other federal entities including the White House Office of Science and Technology Policy (OSTP), National Science Foundation, Food and Drug Administration, and Intelligence Advanced Research Projects Activity (IARPA); and representatives of non-federal organizations participating in the BRAIN Initiative, including the Kavli Foundation, Simons Foundation, and Allen Institute for Brain Science.

#### Welcome and NIH BRAIN Update

Dr. Alan Willard, Acting Deputy Director of the National Institute of Neurological Disorders and Stroke (NINDS) and the MCWG Designated Federal Official, started the meeting and announced the addition of [Dr. Eve Marder from Brandeis University](#) as an at-large member to the MCWG. Dr. Marder replaces Dr. Cori Bargmann, who resigned from the MCWG because of the additional demands on her time as the new leader of the Chan-Zuckerberg Initiative. Dr. Walter Koroshetz, Director of NINDS, and Dr. Joshua Gordon, Director of the National Institute for Mental Health (NIMH), provided an update on the NIH BRAIN Initiative. In the first three years of the Initiative, NIH has supported [233 awards for BRAIN projects](#) conducted by over 400 investigators at more than [140 performance sites in 13 countries](#), and associated with [over 160 scientific articles](#). The BRAIN Initiative is generating vast amounts of data (including imaging, recording, and sequencing data sets), and NIH expects that much of this data, including data standards that are developed, will be made available to the greater neuroscience research community. For fiscal year 2017, the NIH released [three new, related funding opportunity announcements](#) that share a common goal of building an informatics infrastructure for the BRAIN Initiative. In addition to topics of data sharing, discussions surrounded the involvement of international NIH BRAIN participants, strategies for coordinating global brain projects, efforts to hire an NIH BRAIN Director, federal agency integration efforts regarding Brain, [21<sup>st</sup> Century Cures Act](#).

#### Update from Neuroethics Division

Prof. Hank Greely and Dr. Christine Grady, co-chairs of the MCWG Neuroethics Division, discussed new developments from the group, which [convened the day before](#), including:

1. Publication of [Neuroethics in the Age of Brain Projects](#) by Prof. Greely, Dr. Grady, and Executive Secretary to the MCWG Neuroethics Division, Dr. Khara Ramos, as part of the Society for Neuroscience's special issue of *Neuron*.
2. An [NIH Request for Applications](#) associated with the BRAIN Initiative to support neuroethics research.
3. [A commentary piece in Cell](#) by Drs. Sara Goering and Rafael Yuste, which argues for a set of ethical guidelines in the area of neurotechnology research, development, and application.
4. The [Neuroethics panel](#) at the Annual BRAIN Initiative Investigators Meeting.
5. Development of a Neuroethics one pager [link when available], defining neuroethics for BRAIN participants and the greater neuroscience community.
6. Plans for various future neuroethics workshops.

### Update from IARPA

Dr. David Markowitz, a program manager at IARPA, described IARPA's contributions to the U.S. BRAIN Initiative, including projects SHARP, KRNS, and MICrONS, the last of which Dr. Markowitz administers. The goal of SHARP, or [Strengthening Human Adaptive Reasoning and Problem-Solving](#), is to test and validate interventions that may advance adaptive reasoning and problem solving to lead to "improvements in performance for high-performing adults in information-rich environments." KRNS, or [Knowledge Representation in Neural Systems](#), is designed to develop and evaluate new theories and algorithms that will help explain how the human brain processes conceptual knowledge. MICrONS, or [Machine Intelligence from Cortical Networks](#), seeks to revolutionize machine learning by "reverse-engineering" the algorithms of the brain. The MICrONS program consists of 3 technical teams: "The Brain in Action", "Maps at Multiple Scales", and "Identifying Fundamental Principles". Each team is collecting impressive sets of neurophysiological and neuroanatomical data, and will digitally reconstruct and analyze the activity and architecture of the neural circuits.

### Update from the Allen Institute for Brain Science

Dr. Christof Koch, President of and Chief Scientific Officer at the [Allen Institute for Brain Science](#) , described the Institute's contributions to the BRAIN Initiative. The Institute's guiding principles are team science, big science, and open science. The Institute is contributing funding for BRAIN projects involving two species, mouse and human, which will continue until 2022. One major component is the [Allen Mouse Common Coordinate Framework](#) , a tool for understanding the structure and function of the mouse brain at the molecular, cellular, system, and behavioral levels, with the goal of moving toward a Human Common Coordinate Framework. Other projects involve: human transcriptomics, mouse and human *in vitro* single cell characterization, mouse and human Patch-seq (a method that combines patch-clamp recording with single-cell RNA sequencing), synaptic physiology, multiplex fluorescence *in situ* hybridization, and neuropixels. MCWG members commended the Allen Institute for its dedication to using a combination of techniques to study anatomy, physiology, and cell types, as opposed to relying on one particular method to draw conclusions.

## NIH BRAIN Initiative Evaluation with Discussion

Following these exciting updates, Dr. Paul Scott, Director of the NINDS Office of Science Policy and Planning, and Dr. Meredith Fox, Director of the NIMH Office of Science Policy, Planning, and Communications, presented the context for evaluating federal programs, potential methods to evaluate BRAIN at NIH, and highlighted some of the basic data collected from scientists who attended the 3<sup>rd</sup> Annual BRAIN Initiative Investigators Meeting. MCWG members provided feedback and suggestions for evaluating BRAIN, including:

1. Determine the extent to which the tools and technologies have been disseminated and track the success of trainings for such tools.
2. Track the status of diversity and inclusion in the BRAIN workforce.
3. Ensure that methods exist for the sharing, and monitoring, of tools, technologies, and data.
4. Leverage the [NIH](#) and [BRAIN Initiative Alliance](#) websites to disseminate information.
5. Track citations of BRAIN-related publications and patents.

## Mapping BRAIN onto *BRAIN 2025* with Discussion

Next, Dr. Greg Farber, Director of NIMH's Office of Technology Development and Coordination, illustrated how the NIH BRAIN Initiative is progressing in relation to what was mapped out in the [BRAIN 2025 report](#), a document created and released by the BRAIN Working Group of the Advisory Committee to the NIH Director in June 2014. This document identifies seven priority areas for the Initiative, to be achieved over two phases: an initial five years emphasizing technology development, and a second five years emphasizing discovery-driven science. NIH BRAIN Program teams indicated that the field is not saturated – there are plenty of exceptional neuroscientists, engineers, and theorists excited to engage in the BRAIN Initiative. Some of the discussion involved:

1. Creating a funding opportunity specifically emphasizing study of non-neuronal cell types in the brain, such as microglia, astrocytes, oligodendrocytes, etc.
2. An independent group to review data [standards and software development tools](#).
3. How to better involve software engineers, computational scientists, and theorists in the Initiative.
4. Training programs for neuroscientists to learn computational and quantitative methods.
5. Re-forming an advisory committee to review the BRAIN Initiative in its second phase.

## Report on 3<sup>rd</sup> Annual BRAIN Investigators Meeting with Discussion

The meeting concluded with a discussion about the annual BRAIN Initiative Investigators Meeting. Dr. Amy Adams, Director of the NINDS Office of Scientific Liaison, provided information on the [third meeting](#) held December 12-14, 2016, in Bethesda, MD. Meeting attendance grew from previous years to over 750 attendees in-person, including scientific researchers from myriad disciplines, U.S. federal and non-federal BRAIN staff, international brain project managers, as well as members of the press and advocacy groups. The plenary sessions were videocast and archived on the [NIH videocast website](#). There were three scientific keynotes and over 300 scientific poster presentations. Based on discussions with attendees and post-meeting survey results, attendees overwhelmingly expressed enthusiasm for the meeting. Dr. Adams solicited MCWG feedback and suggestions for improvements to the next meeting, which included:

1. Shifting the next meeting to early April 2018.

2. Parallel poster sessions and talks are not ideal, with a preference to make the poster sessions stand-alone - and potentially limit the poster time if necessary.
3. Avoid scheduling evening talks (which were not as well attended), but have poster sessions with networking opportunities occur in the evening instead of during the day.
4. Reach out to various professional societies and see if BRAIN can have a presence at their meetings, in addition to the annual BRAIN meeting.