

The BRAIN Initiative Mission

At the National Institutes of Health (NIH), the Brain Research Through Advancing Innovative Neurotechnologies ® (BRAIN) Initiative aims to revolutionize our understanding of the human brain by accelerating the development and application of innovative technologies.

The BRAIN Initiative is uniquely situated for cross-cutting and accelerated discovery in neuroscience that goes beyond the capability of any single Institute or Center at the NIH by tapping into synergies across multiple fields to address the personal and societal challenges imposed by human brain disorders.

John Ngai, Ph.D. **Director NIH Brain Initiative**

BRAIN by the Numbers



Publications: 2014 - 2022



Publications from... 1166 Pls across 234 Institutes supported by 952 BRAIN Awards



Accelerating Interdisciplinary Neuroscience **Discoveries Across Institutions**



Integrating neuroscience NIH Institutes of Centers:

• NINDS • NIMH NIDCD

• NIA

NCCIH

 NICHD NIBIB • NIDA

• NEL

NIAAA

Scientific Vision: BRAIN Priority Areas



CELL TYPE

Discovering Diversity: Identify different brain cell types and determine their roles in health and disease.



CIRCUIT DIAGRAM

Maps at multiple scales: Generate circut diagrams that vary in resolution from synapses to the whole brain.



MONITOR NEURAL ACTIVITY

The brain in action: Tool development to monitor large-scale neural activity to produce a dynamic picture of the brain.



INTERVENTIONAL TOOLS

Demonstrating causality: Interventional tools to establish causal links between patterns of brain activity and behavior.



THEORY & DATA ANALYSIS TOOLS

Fundamental principles: Theoretical & analytical tools for conceptual understanding of neural processes.



HUMAN NEUROSCIENCE

Advancing human neuroscience through innovative technologies to understand the brain and treat its disorders.



INTEGRATED APPROACHES

Integrate technological/conceptual approaches to discover neural basis of cognition, emotion, perception, and action.

across 10 participating



The BRAIN Initiative Cell Census Network

(**BICCN**) revealed the genetic, cellular, and structural makeup of the human and non-human primate brain in a groundbreaking collection of 21 papers in *Science, Science Advances*, and *Science Translational Medicine* (October, 2023).

Brain single-cell mapping of multiple **brain regions and species across the lifespan** was conducted at unprecedented levels of detail, setting the stage for the BRAIN

Initiative Cell Atlas Network (BICAN) to map the brain's cellular landscape at scale, a critical step toward understanding how the brain functions in health and disease.

One study **identified cell type- and developmental stagespecific genes** that were independently shown by population genetic studies to be associated with neuropsychiatric traits including schizophrenia and bipolar disorder. Such observations provide useful clues for the genetic and cellular basis of these conditions. (*Zhu, Sci Advances, 2023*)

BRAIN 2.0: Looking to the Future

Transformative Projects that will change the future of neuroscience research and accelerating the search for cures (*Ngai*, *Cell*, 2022)



Brain cell atlas: A parts list of the human brain **Microconnectivity:** Wiring diagrams of the brain at unprecendented scale

Precision cell access: An armamentarium of tools to access brain cell types with exquisite specificity

Laying the Foundation for Cures and Understanding What Makes Us Human

Post stroke cerebellar deep brain stimulation is found safe and effective:



- No serious adverse events or device failures were reported
- 9 out of 12 participants showed improvements in motor function following DBS plus physical therapy (*Baker, Nature Medicine, 2023*)

Precise gene delivery to brain cell types across species (*Chen et al, Neuron, 2022*)



PsychLight: Engineering new tools for drug discovery for **depression** (*Dong et al, Cell, 2021*)



New tools for large-scale recordings help listen to neural symphonies in the human brain using "Neuropixel" probes (Caulk et al, Nature Neuroscience, 2022)





Brain recordings reveal how humans store memories (*Zheng et al, Nature Neuroscience, 2022*)

