



Over the past 25 years, the burden of neurological disorders has increased substantially. This increase, combined with the growing burden of mental and substance use disorders, reinforces the need for new ways to intervene and deepen our knowledge of the brain.

Not enough is known about the billions of brain cells—that communicate via trillions of synapses to make up the circuitry—that enable us to perceive, think, feel, and act. The Brain Research through Advancing Innovative Neurotechnologies (BRAIN)® Initiative (www.braininitiative.org) supports research to develop and use extraordinary new technologies that will revolutionize our understanding of the brain.

12-Year Scientific Vision

- Seven priority areas outline the Initiative:



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



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



The brain in action: Produce a dynamic picture of the functioning brain through large-scale monitoring of neural activity.



Demonstrating causality: Link brain activity to behavior with precise interventional tools that change neural circuit dynamics.



Identifying fundamental principles: Produce conceptual foundations for understanding mental processes by developing new theoretical and analytical tools.



Advancing human neuroscience: Develop innovative technologies to understand the human brain and treat its disorders; create and support human brain research networks.



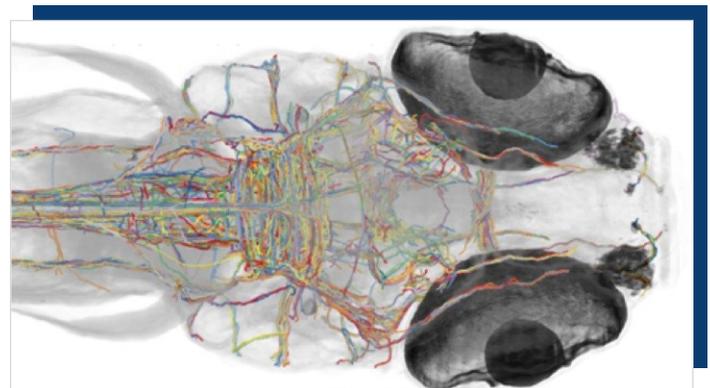
From BRAIN Initiative to the brain: Apply new technological/conceptual approaches to discover how neural activity patterns transform into cognition, emotion, perception, and action.

At a glance...



- ◆ Launched in 2013, the NIH BRAIN Initiative is revealing how the brain works, by developing and applying tools to precisely map and observe brain circuits.
- ◆ The 21st Century Cures Act provides NIH BRAIN Initiative funding through 2026.
- ◆ NIH has invested over \$950 million in the BRAIN Initiative, supporting over 550 new awards.
- ◆ Ten NIH Institutes and Centers participate in the NIH BRAIN Initiative.
- ◆ The BRAIN Initiative Alliance communicates BRAIN Initiative activities of Federal agencies and private organizations.

- The **BRAIN Multi-Council Working Group (MCWG)** helps NIH to track the Initiative and assists with informing Advisory Councils of the Institutes and Centers that contribute to the NIH BRAIN Initiative.
- The **BRAIN Neuroethics Working Group (NEWG)** considers ethical implications arising from the development and use of BRAIN neurotechnologies and is complemented by BRAIN-funded neuroethics research.
- As the BRAIN Initiative moves into its second half, a new scientific expert Working Group and neuroethics subgroup continue to solicit input and provide feedback to NIH on how best to carry out this ambitious vision through 2026, in light of rapid advances and emerging opportunities.



BRAIN Initiative funding allowed researchers to apply whole-brain imaging and connectomics to chart a detailed diagram of zebrafish brain circuits. Image credit: Hildebrand DGC et al. (2017) Nature 545:345-349

BRAIN Initiative Highlights:

- In FY18, the NIH BRAIN Initiative funded over 200 new and first-time research projects at over 80 unique institutions, from small exploratory studies to large, multi-site collaborations.
- BRAIN investigators bring new multidisciplinary perspectives to brain research, including engineers, physicists, mathematicians, computer scientists, and other experts as well as neuroscientists.
- New technologies enable researchers to map, monitor, and manipulate brain circuits in animal models with unprecedented precision in time and space, which may lead to new therapeutic approaches in humans.
- The BRAIN Initiative Cell Census Network is compiling a reference atlas of cell types in human, non-human primate, and mouse brains.
- The BRAIN Public-Private Partnership Program encourages collaborations between researchers and manufacturers of neural stimulation and recording devices.
- An annual meeting brings together all BRAIN-related investigators.
- The Initiative is increasing investments in dissemination of tools, training, and data resources that will energize the entire neuroscience research community.
- For more information on the NIH BRAIN Initiative, see www.braininitiative.nih.gov

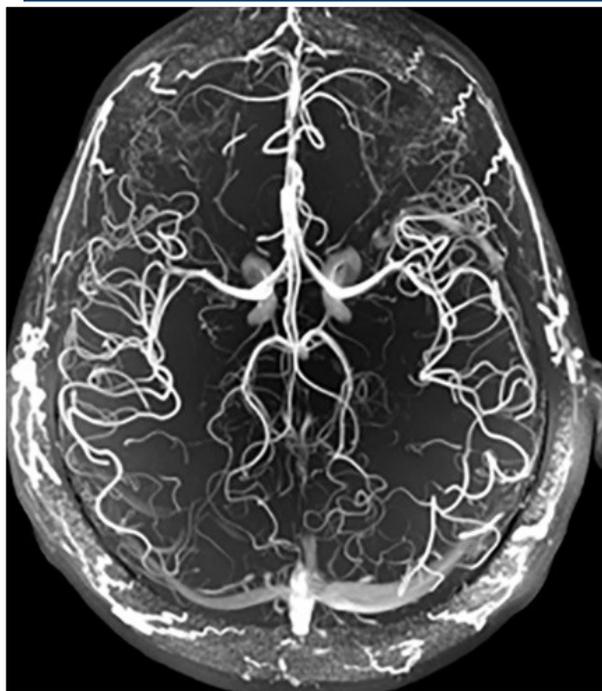
NIH FY 2014-2018 BRAIN investments: Not business as usual

DATE	INVESTMENT	NEW AWARDS
FY 2014	>\$45M	>55
FY 2015	>\$85M	>65
FY 2016	>\$155M	>105
FY 2017	>\$260M	>110
FY 2018	>\$400M	>200
TOTAL	~\$950M	>530

“The human brain is the most complicated biological structure in the known universe.

We’ve only just scratched the surface in understanding how it works.”

—Francis S. Collins, M.D., Ph.D.
NIH Director



The BRAIN Initiative supports innovations in the next generation of human imaging technologies, like this magnetic resonance angiography that displays the vasculature throughout the human brain at high-resolution. Image credit: J.R. Plimeni and L.L. Wald, MGH

Collaborations beyond NIH:

- BRAIN Initiative partners beyond NIH include other government agencies, private foundations, industry, and international organizations.
- Federal agencies include:
 - ◊ Defense Advanced Research Projects Agency (DARPA),
 - ◊ National Science Foundation (NSF),
 - ◊ Food and Drug Administration (FDA), and
 - ◊ Intelligence Advanced Research Projects Activity (IARPA).
- Private foundations include:
 - ◊ The Kavli Foundation,
 - ◊ Allen Institute for Brain Science, and
 - ◊ Simons Foundation.
- Global collaborations have expanded to include the **International Brain Initiative**. NIH has supported brain research in more than a dozen countries since 2013.



NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.