

*As the burden of neurological, mental, and substance use disorders increases, there is an urgent need for new ways to deepen our knowledge of the brain and intervene.*

*At the National Institutes of Health (NIH), the Brain Research Through Advancing Innovative Neurotechnologies® (BRAIN) Initiative ([www.braininitiative.nih.gov](http://www.braininitiative.nih.gov)) has supported research to develop and use extraordinary new technologies that will revolutionize our understanding of the brain. Bold strides in the first phase of this quest have enabled researchers to look at individual brain cells and listen in as thousands of neurons talk to each other, paving the way for revolutionary basic, clinical, and translational advances.*

### 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.



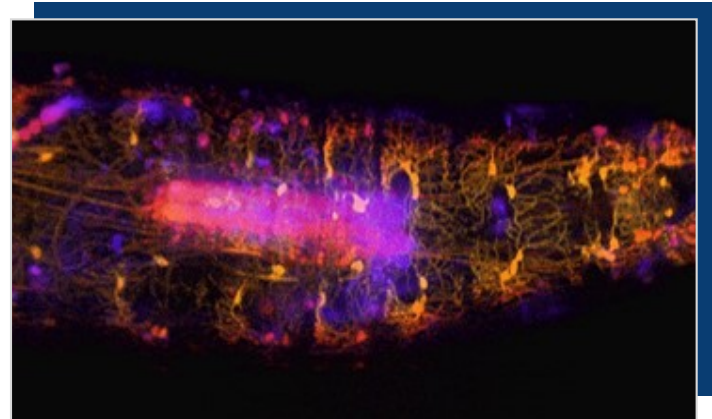
**From BRAIN Initiative to the brain:** Apply new technological/conceptual approaches to discover how neural activity patterns transform into cognition, emotion, perception, and action.

### 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 21<sup>st</sup> Century Cures Act provides NIH BRAIN Initiative funding through 2026.
- ◆ Since 2014, NIH has invested over \$2.4 billion in the BRAIN Initiative, supporting over 1100 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)** provides ongoing oversight of the long-term scientific vision and informs Advisory Councils of the Institutes and Centers contributing to the NIH BRAIN Initiative.
- The **BRAIN Neuroethics Working Group (NEWG)** ensures that neuroethical considerations are fully integrated into the science and its work is complemented by BRAIN-funded neuroethics research.
- In its second phase, the Initiative is informed by reports from the **Advisory Committee to the NIH Director (ACD) BRAIN Initiative Working Group 2.0** and **BRAIN Neuroethics Subgroup**, which provide strategic guidance on how best to carry out this ambitious vision, in light of rapid advances and emerging opportunities.



*BRAIN Initiative funding allowed researchers to image activity of fruit fly larvae in real-time, detailing their sensory and motor circuits. Vaadia et al. (2019) Current Biology*

## BRAIN Initiative Highlights:

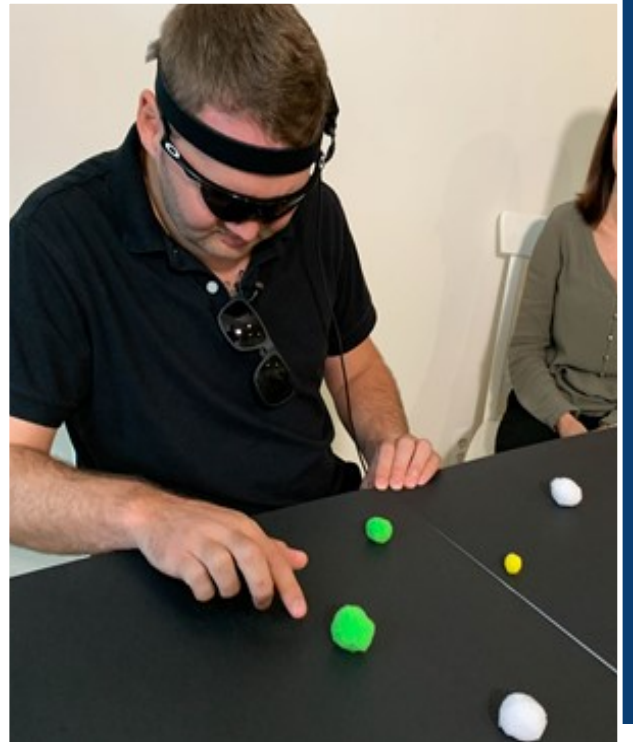
- In FY21, the NIH BRAIN Initiative funded over 200 new and first-time research projects at numerous institutions, from small exploratory studies to large, multi-site collaborations.
- BRAIN investigators bring new multidisciplinary perspectives to brain research, including engineers, physicists, mathematicians, 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 Initiative is increasing investments in diversity and inclusion, as well as in dissemination of tools, training, and data resources that will energize the entire neuroscience research community.
- The BRAIN Public-Private Partnership Program encourages collaborations between researchers and manufacturers of neural stimulation and recording devices.
- Built on the early successes from the first half of the Initiative, the second phase of BRAIN outlines plans for transformative, large-scale projects. These efforts will support the development and dissemination of important resources and data to propel neuroscience far into the future.
- An annual meeting brings together all BRAIN-related investigators from NIH and its partners.

### NIH FY 2014-2021 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
FY 2019	>\$420M	>165
FY 2020	>\$495M	>175
FY 2021	>\$540M	>200
TOTAL	>\$2.4M	>1100

*“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, including this partnership study that restored visual perception to the blind. J. Dorn, R. Greenberg, and N. Pouratian. Photo credit: UCLA Health and UCLA Neurosurgery.*

## Collaborations beyond NIH:

- BRAIN Initiative partners beyond NIH include other government agencies, private foundations, industry, and professional and international organizations.
- Federal agencies include:
  - ◊ Defense Advanced Research Projects Agency (DARPA)
  - ◊ National Science Foundation (NSF)
  - ◊ Food and Drug Administration (FDA)
  - ◊ Intelligence Advanced Research Projects Activity (IARPA)
- Private foundations include:
  - ◊ Institute of Electrical and Electronics Engineers
  - ◊ The Kavli Foundation
  - ◊ Allen Institute for Brain Science
  - ◊ Simons Foundation
  - ◊ American Brain Coalition
  - ◊ Dana Foundation
  - ◊ International Neuroethics Society

Global collaborations have expanded to include the **International Brain Initiative**. NIH has supported brain research in more than a dozen countries since 2013.

For more information on the NIH BRAIN Initiative, see [www.braininitiative.nih.gov](http://www.braininitiative.nih.gov)

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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.