

The US BRAIN Initiative

Brain Research through Advancing Innovative Neurotechnologies



Professor of Neuroscience



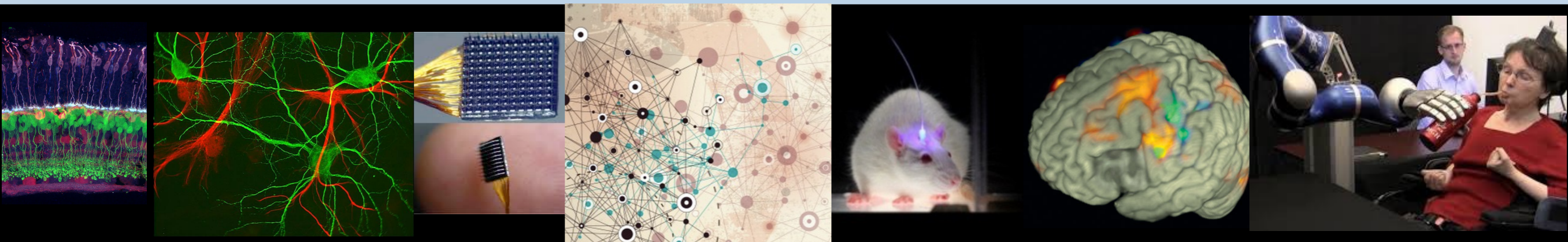
John Donoghue, Ph.D.
member US BRAIN
Advisory Committee to the NIH Director

views expressed here are my own and not those of the US Government



Director

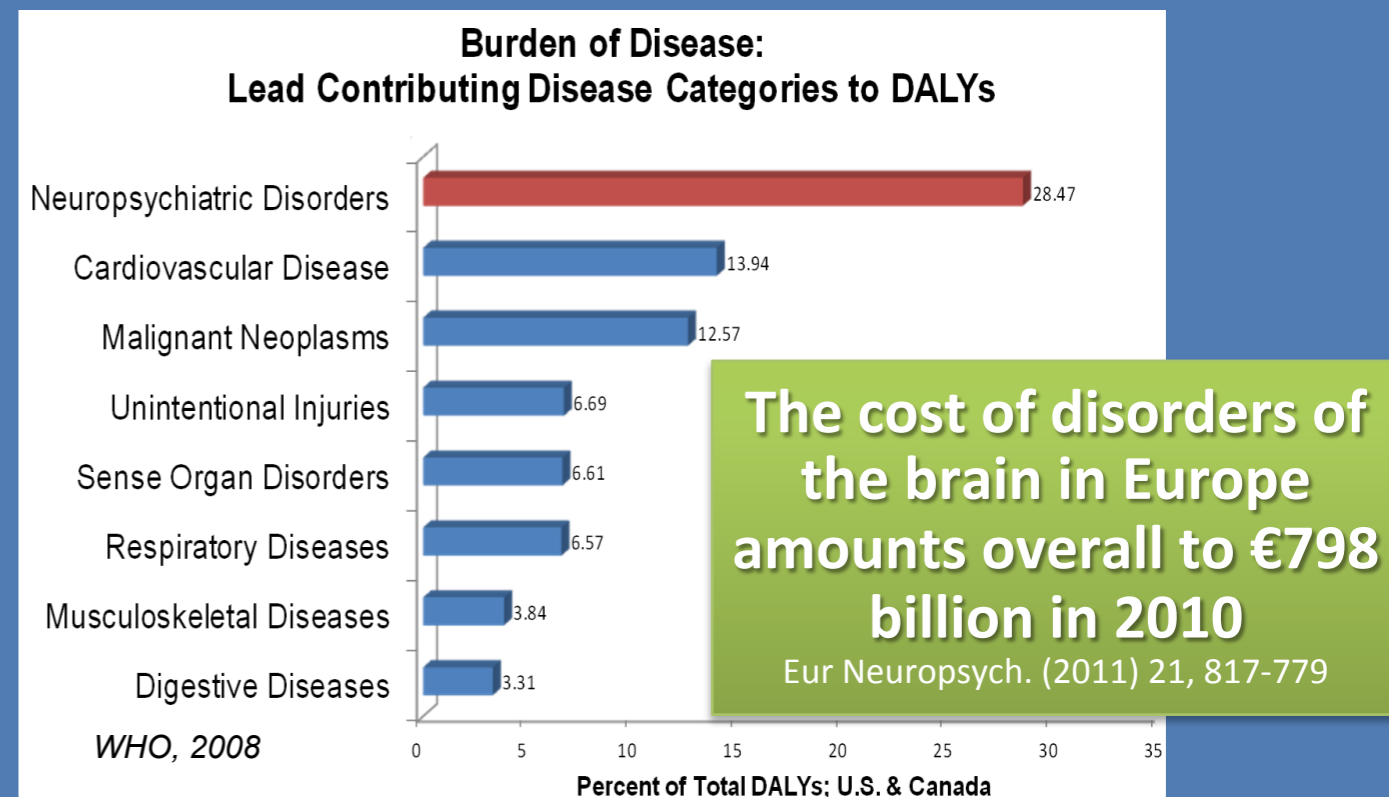
1



Why a US BRAIN Initiative?

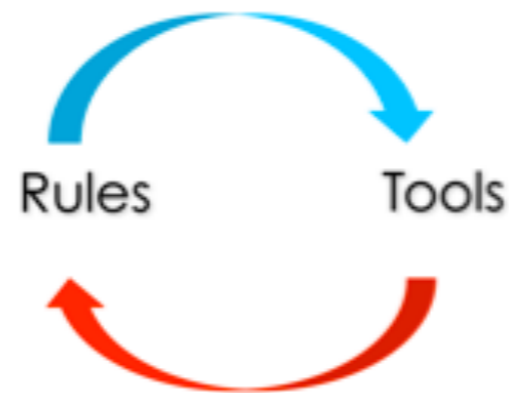
The Need Is Great

- Brain disorders: #1 source of disability in U.S.
 - > 100 million Americans affected
- Rates are increasing
- Costs are increasing-
 - annual cost of dementia ~\$200B
 - by 2050 >\$1 Trillion
 - Already equals cost of cancer and heart disease



The Challenge for the 21st Century

We do NOT know enough about the brain



source: Donoghue

“The Next Great American Project”



“So there is this enormous mystery waiting to be unlocked, and the BRAIN Initiative will change that by **giving scientists the tools they need to get a dynamic picture of the brain in action** and better understand how we think and how we learn and how we remember. And that knowledge could be – will be – transformative.”

-- President Obama, April 2, 2013⁴

US BRAIN Initiative

“a public and private effort”



I A R P A

+

Private
Investments



SIMONS FOUNDATION

The NIH BRAIN Scientific Plan

- NIH Advisory Committee to the Director-Working Group (scientists, federal officials)
- Met 2013-14
- Broad input from scientific community
- Released June 2014



William Newsome, PhD (co-chair)
Stanford University



Cornelia Bargmann, PhD
(co-chair)
The Rockefeller University

FIRST FIVE YEARS

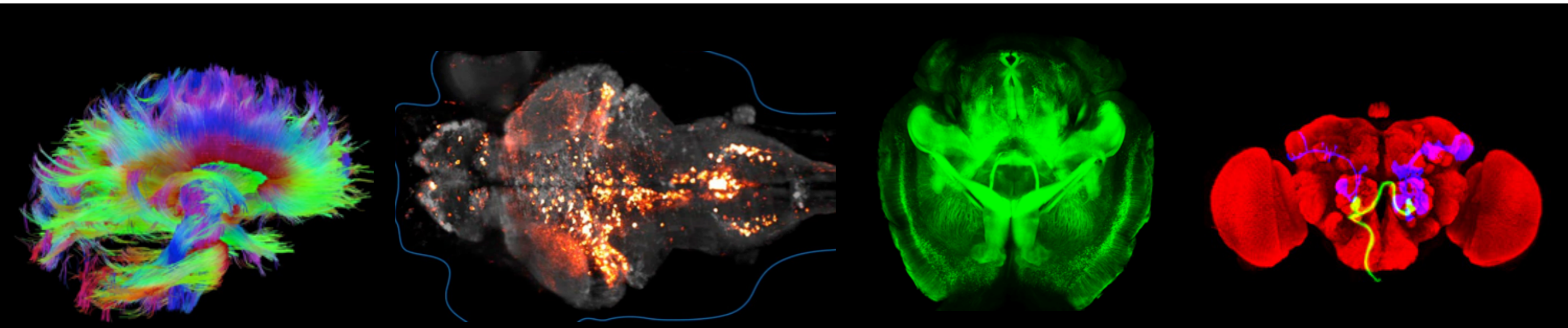
Emphasize technology
development

SECOND FIVE YEARS

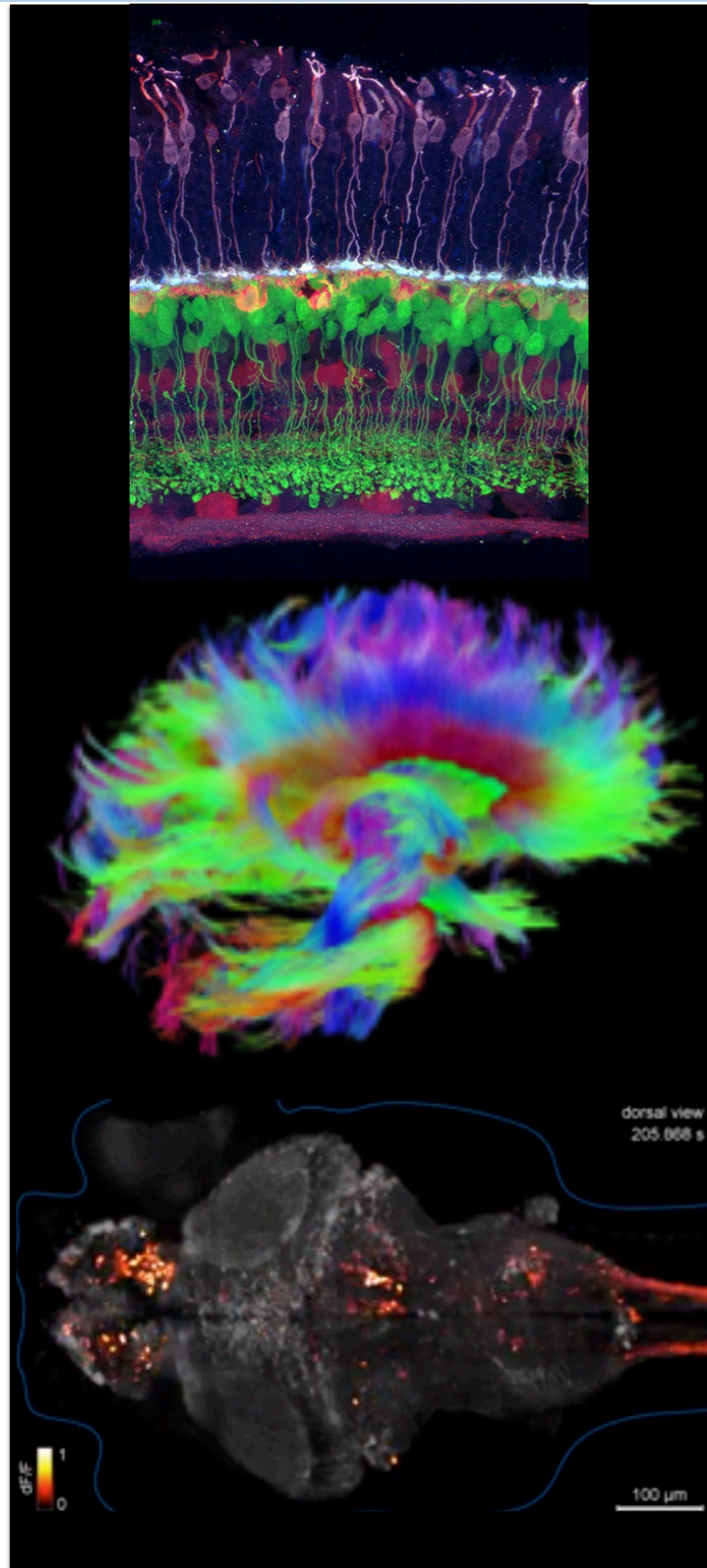
Emphasize discovery
driven science

Understanding the Brain as a SYSTEM

To map the circuits of the brain, measure the fluctuating patterns of electrical and chemical activity flowing within those circuits, and understand how their interplay creates our unique cognitive and behavioral capabilities.



US BRAIN Initiative NIH Seven Priorities



- Cell Types (catalog)
- Wiring diagram
- Network Function
- Link Brain-Behavior
- Theory and Analysis
- Human Neuroscience
- Integrate:
 - Cognition, emotion, perception, action
 - Health and Disease

$$p(\mathbf{x}) \propto \exp\left(-\frac{1}{2}(\mathbf{x} - \boldsymbol{\mu})^T \mathbf{Q}^{-1}(\mathbf{x} - \boldsymbol{\mu})\right)$$

US BRAIN Initiative

BRAIN 2025 A SCIENTIFIC VISION

Brain Research through Advancing Innovative
Neurotechnologies (BRAIN) Working Group
Report to the Advisory Committee to the
Director, NIH

June 5, 2014



Principles

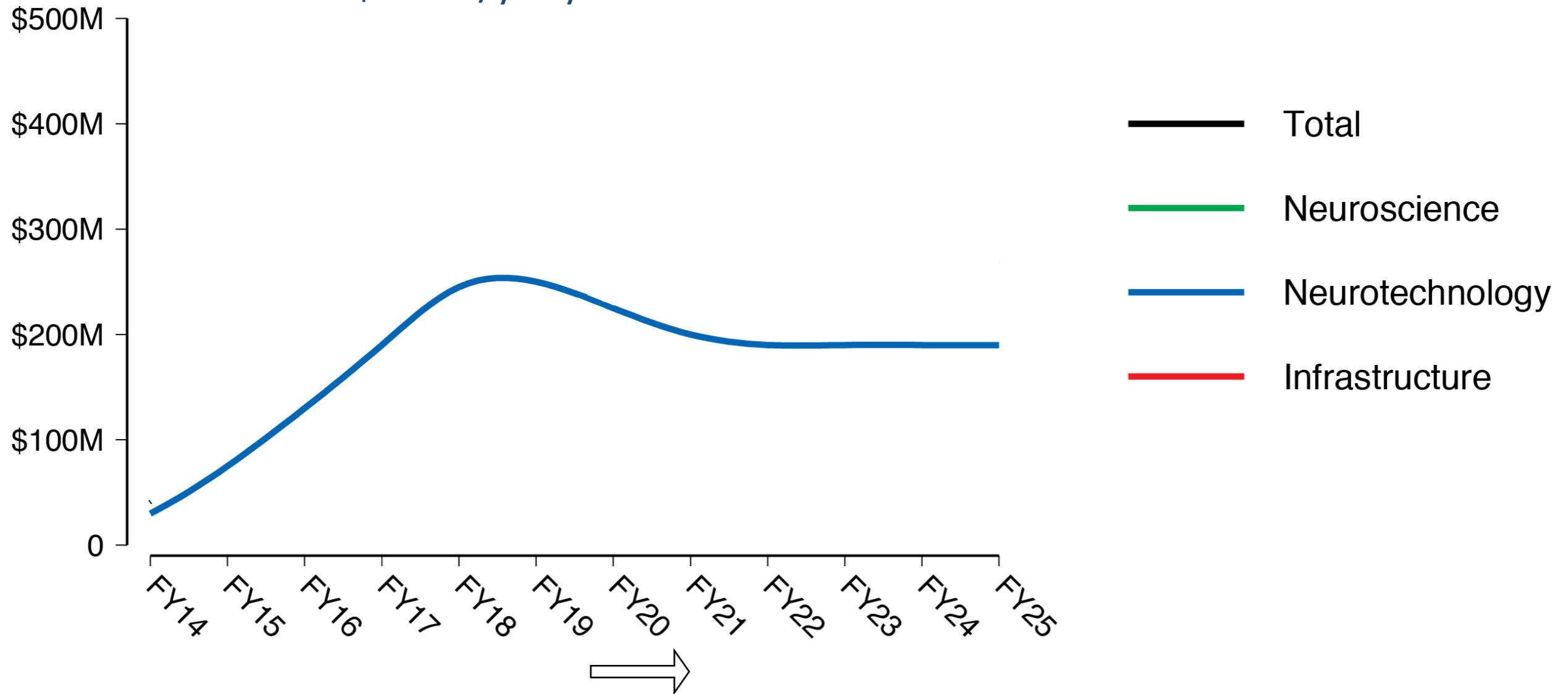
1. Pursue human and non-human animal studies in parallel
2. Cross boundaries in interdisciplinary collaborations
3. Integrate spatial and temporal scales
4. Establish platforms for sharing data and tools
5. Validate and disseminate technology
6. Consider ethical implications of neuroscience research
7. Accountability to NIH, taxpayers, and the scientific community

US BRAIN Initiative

Recommended Budget \$4.5B

Ramp up to \$400M/yr by FY 2018

Plateau at \$500M/yr by FY2021



Total investment of \$4.5B by FY 2025

US BRAIN Initiative NIH

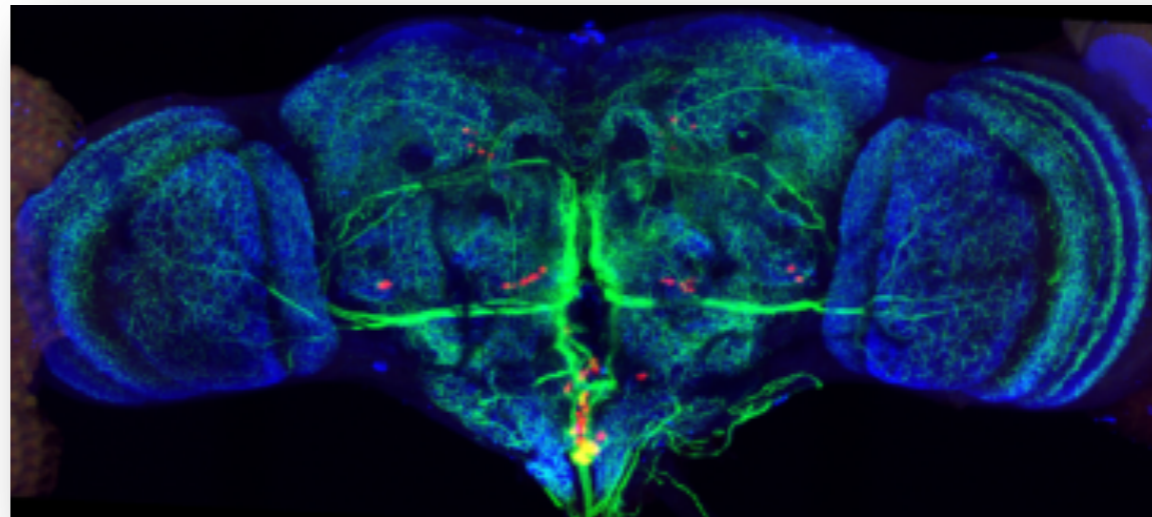
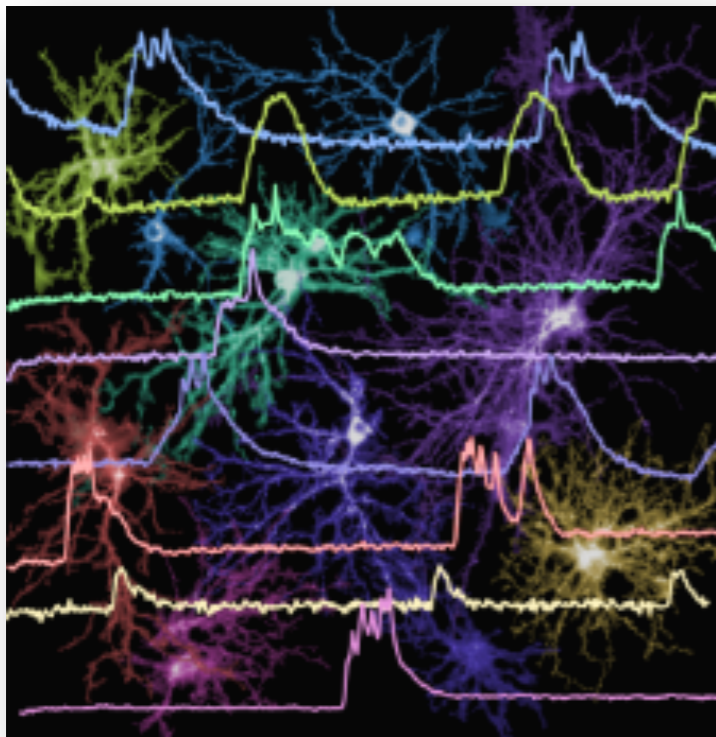
Budget Reality

Fiscal Year	Actual Budget	ACD Working Group Estimate
FY14	\$46M	
FY15	\$80M	\$100M
FY16	\$150M	\$190M
FY17	?...	\$300M
FY18		\$400M
FY19		\$500M

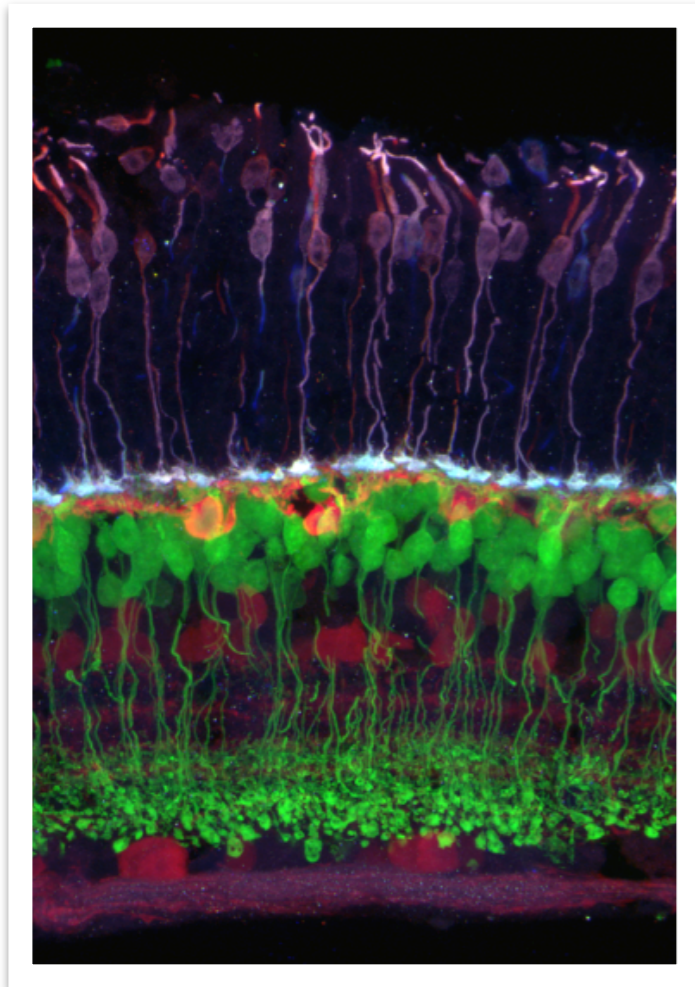
NIH BRAIN Funding in FY14



- \$46M
- 58 projects
- Over 100 investigators in 15 states and 3 countries



The BRAIN InitiativeSM: Action-*Funded*



Map of cell types based solely on gene expression



Track movements of neurotransmitters in real-time



Complete wiring diagram of the retina



Stimulate neural circuits with radio waves



Develop a human brain imaging device 100 x more sensitive than MRI



Develop a wearable PET scanner

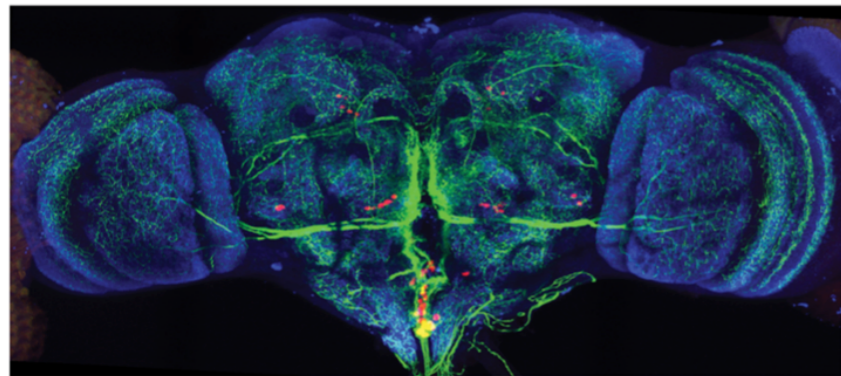
US BRAIN Initiative: Action

Multi Council Working Group

- Engages US BRAIN agencies:
 - NIH, DARPA, FDA, IARPA, NSF
- Communication
- Concepts
- Interactions

US BRAIN Initiative: Action

BRAIN Initiative INVESTIGATOR'S KICKOFF MEETING



 **NOV
20-21
2014** | BETHESDA NORTH MARRIOTT
HOTEL & CONFERENCE CENTER
 5701 Marinelli Road • Bethesda, MD

Hosted by both the National Institutes of Health and the National Science Foundation

  National Institutes of Health 

Nov. 20-21 2014

- Joint NIH-NSF meeting w DARPA and HHMI
- Over 100 investigators, 70 projects
- Setting goals: Expectations, Interaction, Coordination, and Collaboration
 - Data Management
 - Integrating/Bridging Scales
 - Technology Implementation
 - Research Coordination

Now an annual meeting (next one early Dec, 2015)

BRAIN Funding Opportunities: FY15

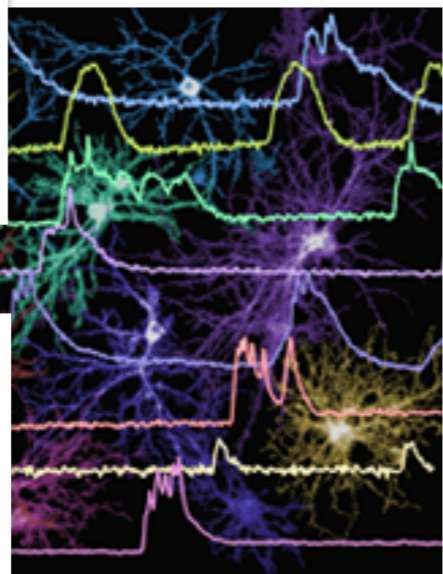
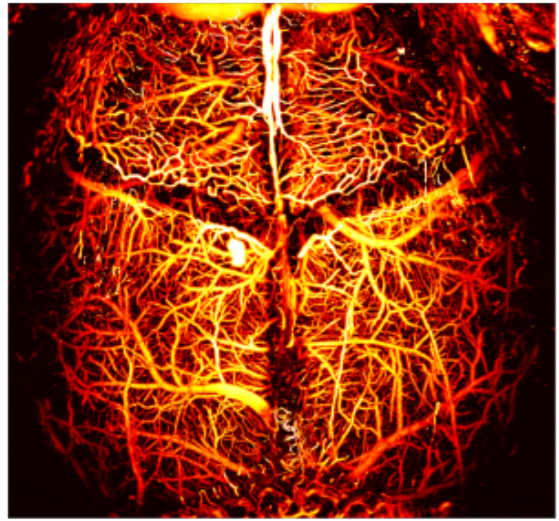
\$80M NIH

Ongoing funding Opportunities:
technology and discovery science

Short Courses for Educational Activities

US BRAIN Initiative: Next Steps

Commercial Partners and Collaborations



- Engage small businesses in tool and technology development
- Partner with manufacturers for clinical studies
- Create a culture of neuroscience research that emphasizes
 - worldwide collaboration,
 - open sharing of results and tools,
 - mutual education across disciplines

GE,
Google, GlaxoSmithKline, and
Inscopix

US BRAIN Initiative: Next Steps

International Collaborations

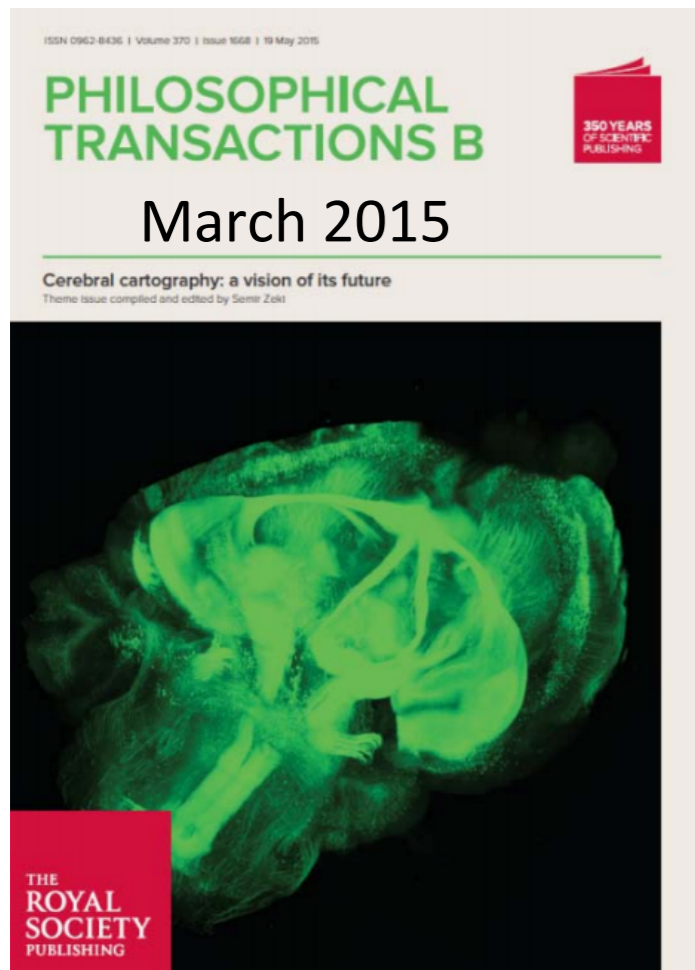
US in Discussions with

“Australia and Canada”

Neurodata without Borders with EU- HB



US BRAIN Initiative



<http://braininitiative.nih.gov/>



Special Thanks to:
Samantha White, Ph.D.
AAAS S&T Policy Fellow | Health Scientist NIH/OD
NIH BRAIN Initiative Coordinating Committee

Fellow members of the NIH ACD
Working Group
US BRAIN INITIATIVE