

NIH and the BRAIN Initiative

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Director, National Institutes of Health

Meeting of the President's Council of Advisors on
Science and Technology

May 3, 2013



A Bold New Initiative in American science

★ ★ ★ ★ the WHITE HOUSE ★ ★ ★ ★

PRESIDENT OBAMA IS CALLING ON THE SCIENCE COMMUNITY
TO JOIN HIM IN PURSUING A GRAND CHALLENGE

BRAIN BRAIN RESEARCH
INITIATIVE THROUGH ADVANCING
INNOVATIVE
NEUROTECHNOLOGIES



Learning the language of the brain

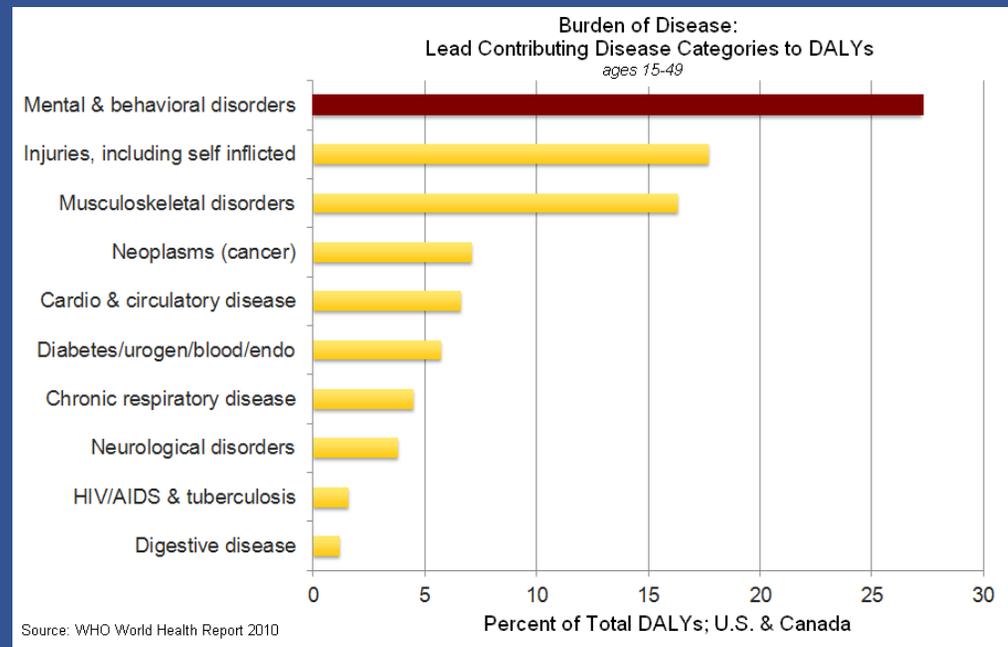
The Need Is Great

- Brain disorders: #1 source of disability in U.S.
 - > 100 million Americans affected
- Rates are increasing: autism, Alzheimer's disease, and in our soldiers PTSD and TBI



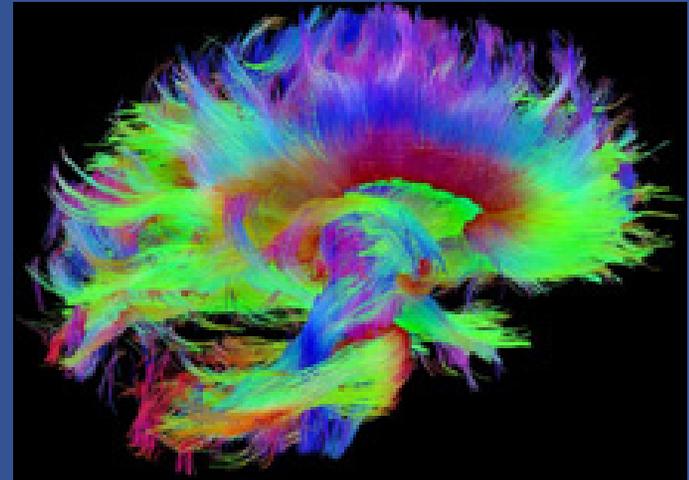
The Need Is Great

- Brain disorders: #1 source of disability in U.S.
 - > 100 million Americans affected
- Rates are increasing: autism, Alzheimer's disease, and in our soldiers PTSD and TBI
- Costs are increasing: annual cost of dementia ~\$200B
 - Already equals cost of cancer and heart disease



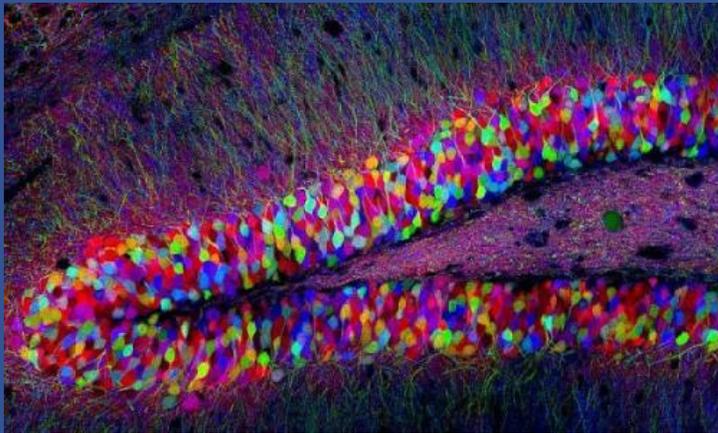
The Science Is Ready

- Progress in neuroscience is yielding new insights into brain structure, function

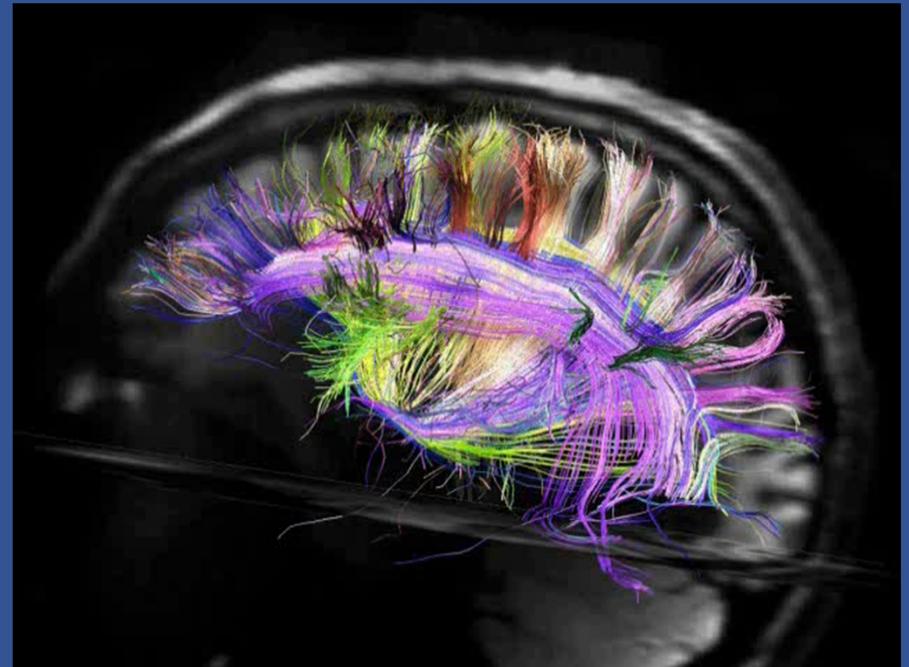


- Progress in optics, genetics, nanotechnology, informatics, etc. is rapidly advancing design of new tools

Advances in Understanding Brain Structure



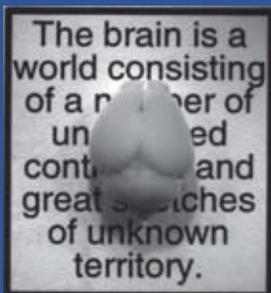
Brainbow (Livet et al., 2007)



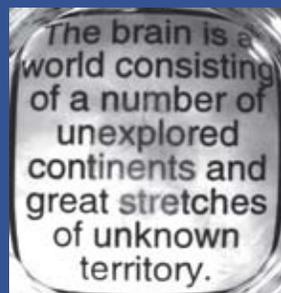
Human Connectome

(Wedge et al., 2012)

Before



After CLARITY

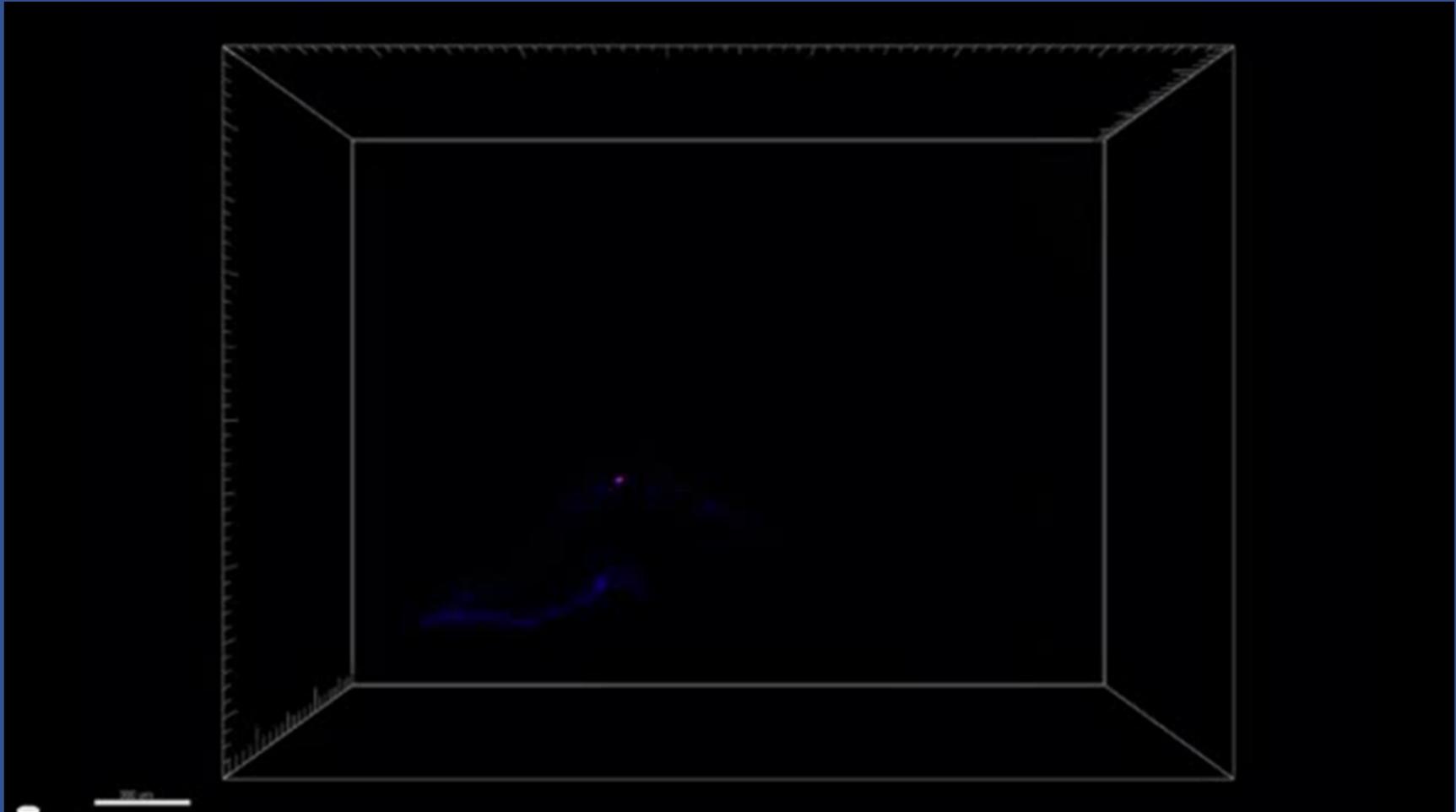


After CLARITY



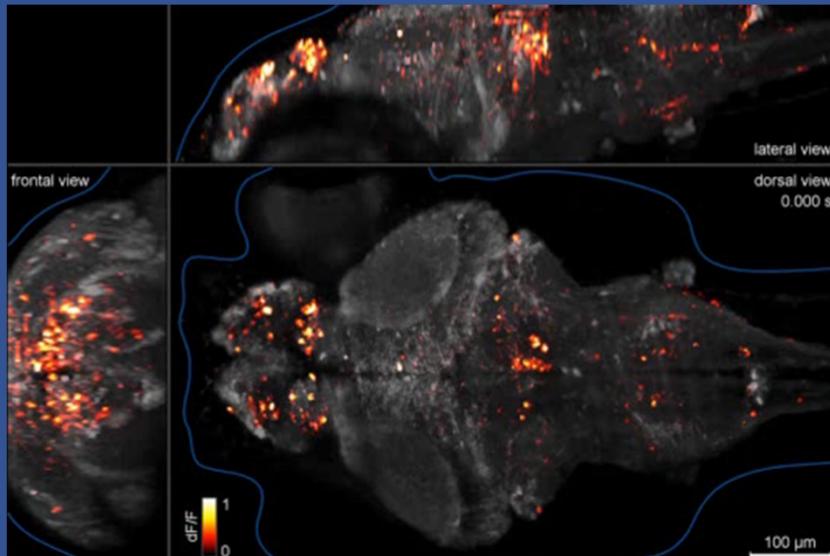
CLARITY (Chung et al., 2013)

Advances in Understanding Brain Structure: **CLARITY**



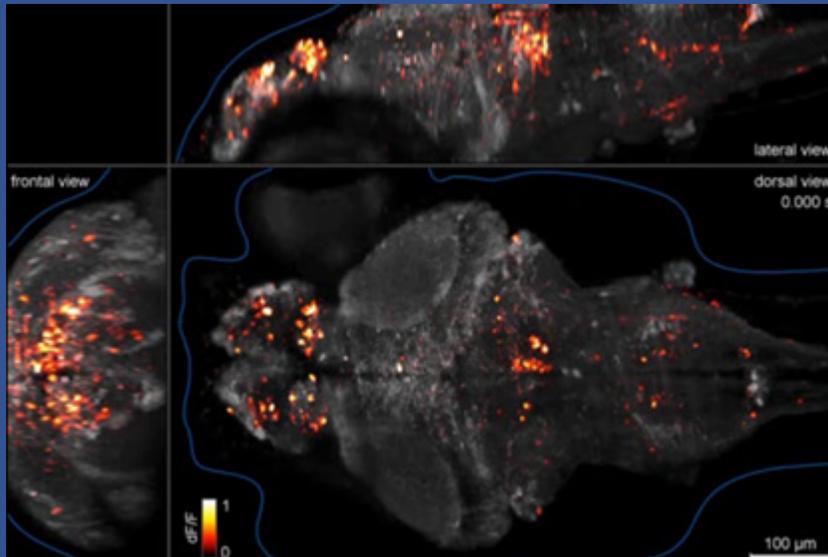
3D analysis of an intact mouse hippocampus

Advances in Understanding Brain Function

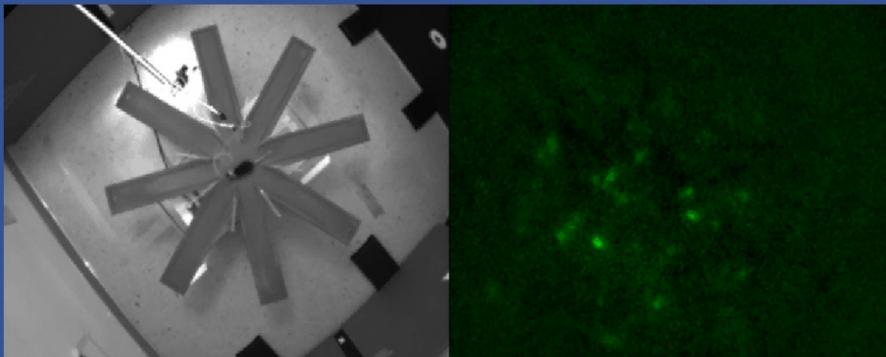


Zebra fish larvae (Ahrens et al., 2013)

Advances in Understanding Brain Function

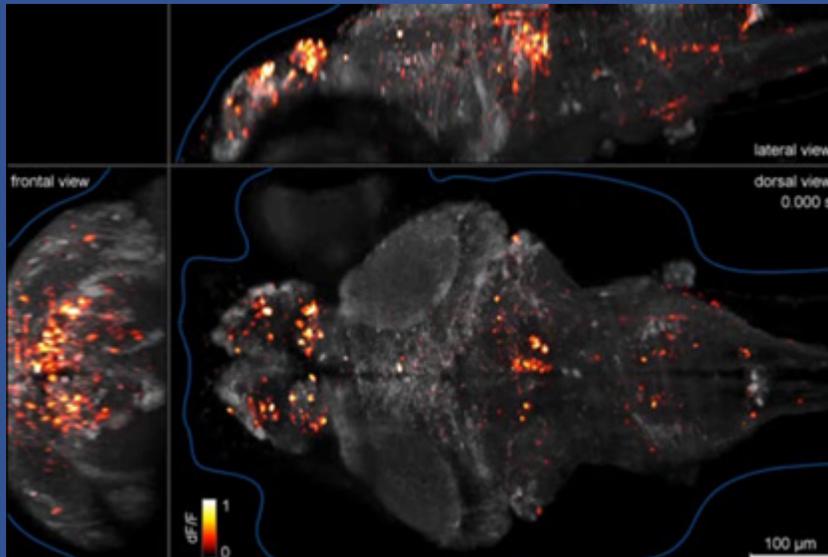


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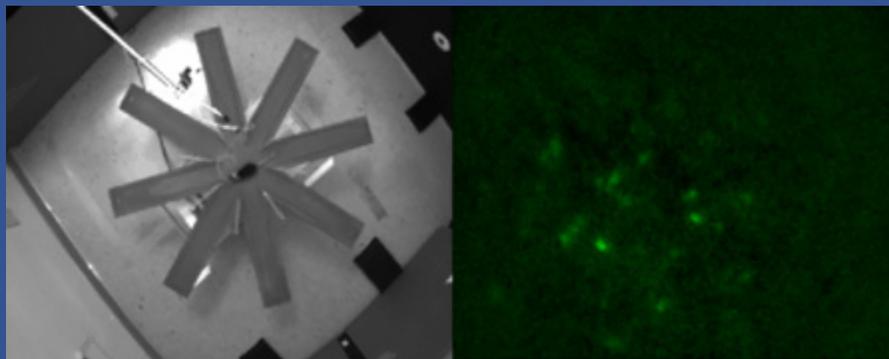


1202 hipp neurons (Schnitzer laboratory)

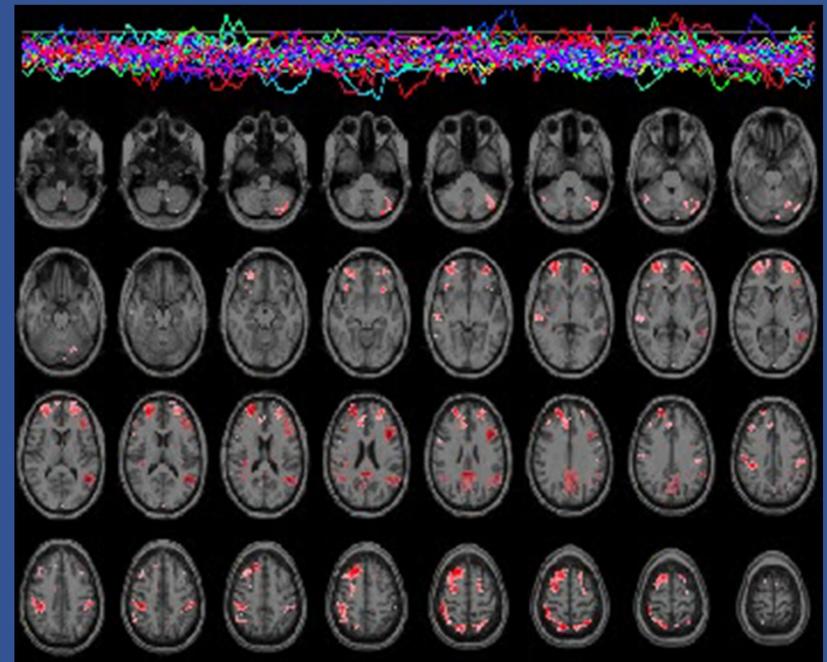
Advances in Understanding Brain Function



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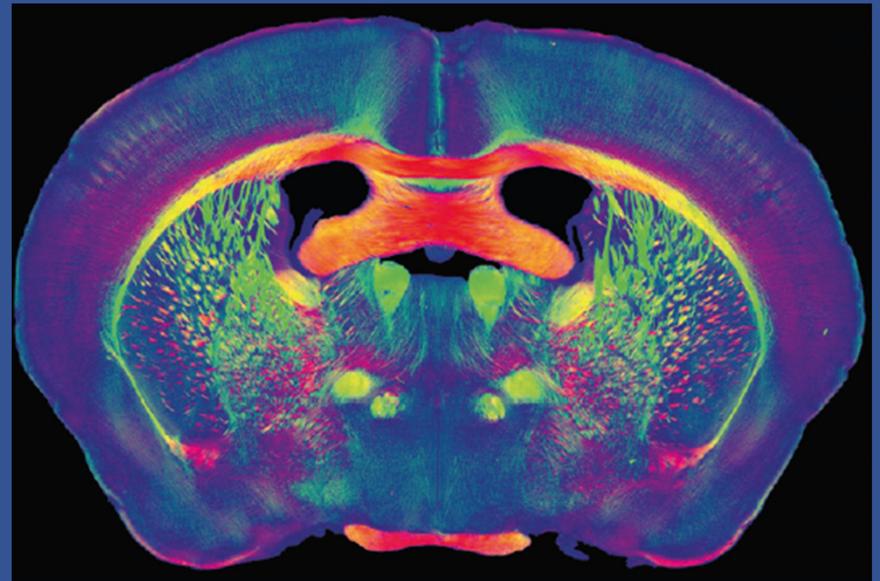
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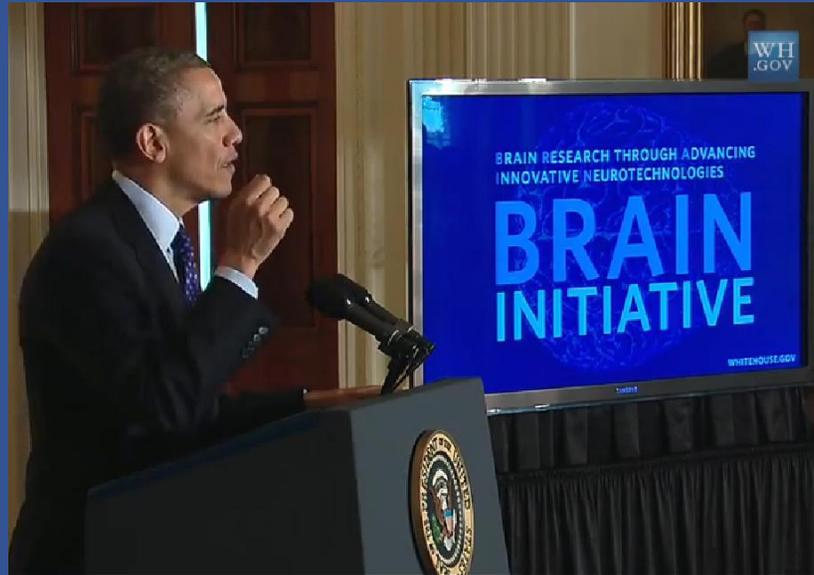
21 transient functional modes (K. Ugurbil 2012)

Making the Next Leap

- *Today:* despite advances, we are still limited in our understanding of how the brain processes information
- *Tomorrow:* sophisticated new tools, technologies, will help us understand how:
 - Parts of the brain *work together* to generate patterns of activity
 - Patterns of activity are *translated* into thoughts, behaviors, emotions
 - Experience alters brain's *organization*



The Vision



“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, 2013

BRAIN Initiative Partners

FY2014 Investments

Government Agencies	\$ in Millions
National Institutes of Health	\$40
Defense Advanced Research Projects Agency	\$50
National Science Foundation	\$20
Private Organizations	
Allen Institute for Brain Science	\$60
Howard Hughes Medical Institute	\$30
Salk Institute for Biological Studies	\$28
The Kavli Foundation	\$4

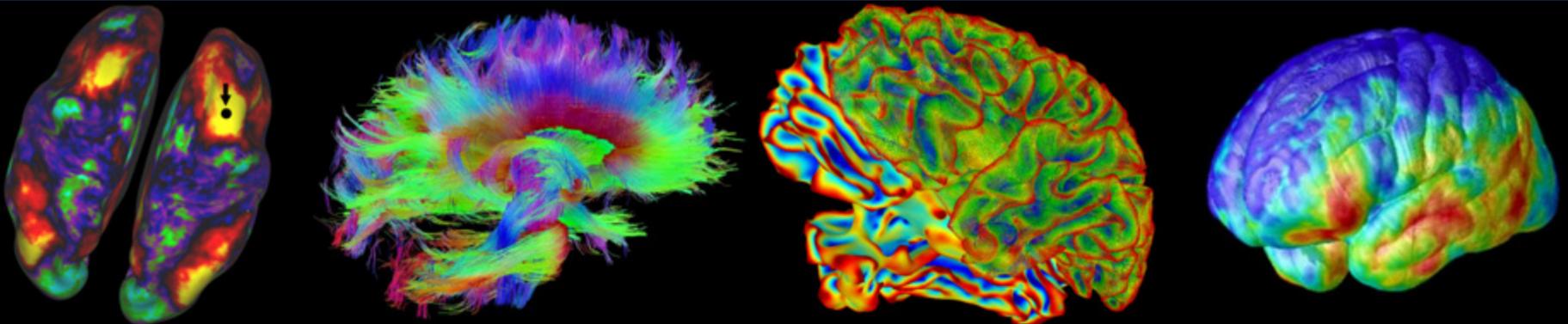




NIH BRAIN

Goals of NIH BRAIN

- Accelerate development, application of innovative technologies to construct dynamic picture of brain function that integrates neuronal and circuit activity over time and space
- Build on growing scientific foundation – neuroscience, genetics, physics, engineering, informatics, nanoscience, chemistry, mathematics, etc. – to catalyze interdisciplinary effort of unprecedented scope



How Will NIH BRAIN Work?

- Plan to be developed by NIH Advisory Council to the Director BRAIN Working Group
 - Selected for visionary leadership, expertise
 - Charged with articulating scientific goals, developing plan
 - Including timetables, milestones, costs
- Informed by experts across sectors and disciplines; assisted by NIH Blueprint for Neuroscience Research
- NIH BRAIN Working Group will
 - Seek broad input; hold open meetings, workshops
 - Deliver interim report on high-priority areas for FY14 funding in summer 2013; final report, June 2014

NIH Neuroscience BRAIN Team

Cornelia Bargmann, PhD (co-chair)

The Rockefeller University

Bill Newsome, PhD (co-chair)

Stanford University

David Anderson, PhD

California Institute of Technology

Emery Brown, MD, PhD

Massachusetts Institute of Technology

Karl Deisseroth, MD, PhD

Stanford University

John Donoghue, PhD

Brown University

Peter MacLeish, PhD

Morehouse School of Medicine

Eve Marder, PhD

Brandeis University

Richard Normann, PhD

University of Utah

Joshua Sanes, PhD

Harvard University

Mark Schnitzer, PhD

Stanford University

Terry Sejnowski, PhD

Salk Institute for Biological Studies

David Tank, PhD

Princeton University

Roger Tsien, PhD

University of California, San Diego

Kamil Ugurbil, PhD

University of Minnesota

EX OFFICIO MEMBERS

Kathy Hudson, PhD

National Institutes of Health

Geoffrey Ling, MD, PhD

Defense Advanced Research Projects Agency

John Wingfield, PhD

National Science Foundation

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NIH Blueprint

for Neuroscience Research

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Public will be able to receive updates, contribute to discussion, at <http://www.nih.gov/science/brain/>

Stephen Colbert Monitors His Brain Activity



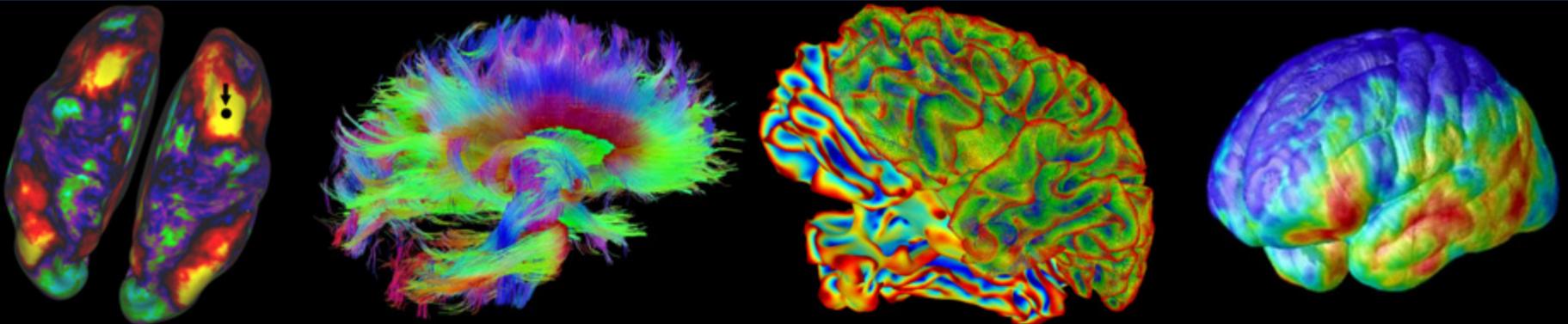
The Colbert Report



April 4, 2013

Features of NIH BRAIN

- Impact on support for other research
 - NIH spends approximately \$5.5B on neuroscience research; BRAIN is <1%
- Potential for wide-ranging benefits
 - Dedicated to providing tools to enhance many areas of research
 - Should provide methods for deeper understanding of all brain disorders



A white line drawing of a human brain, viewed from a slightly elevated side angle, set against a solid blue background. The drawing uses fine lines to depict the complex folds and sulci of the cerebral cortex. The text is overlaid on the central part of the brain.

***“The Next Great
American
Project”***

— *President Barack Obama*



NIH...

Turning Discovery Into Health®

