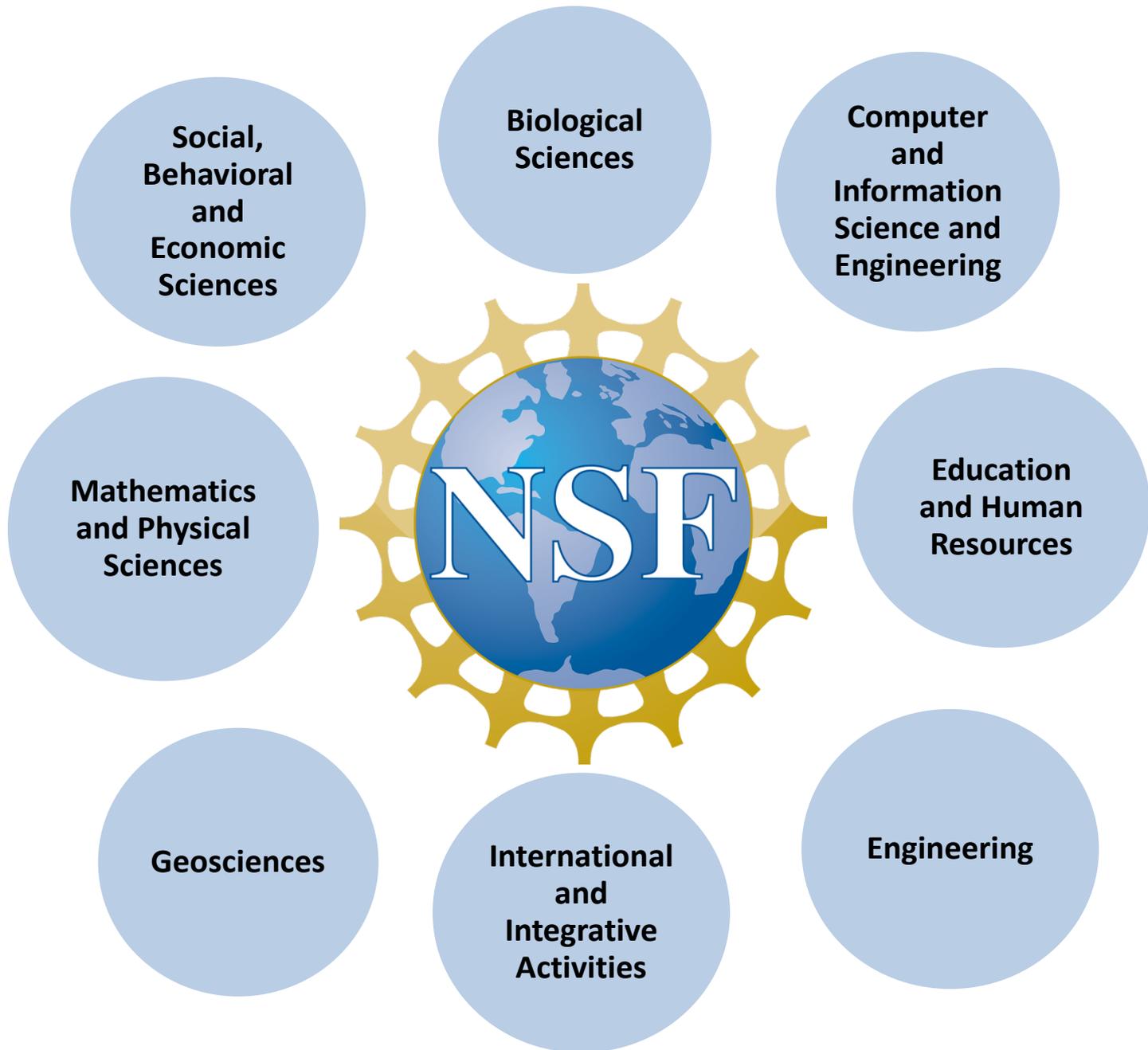




# BRAIN Initiative: NSF Activities

Dr. Edda (Floh) Thiels  
Program Director  
Integrative Organismal Systems Division

EPSCoR PD and PA Meeting  
18 May 2015



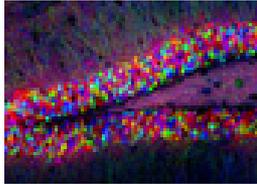
# NSF BRAIN Initiative – Thematic Areas

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***Goal: Generate an array of physical and conceptual tools to determine how healthy brains of humans and other organisms function***



Multi-scale Integration of Brain Dynamic Activity and Structure



Neurotechnology and Research Infrastructure



Quantitative Theory and Modeling of Brain Function



Brain-Inspired Concepts and Designs



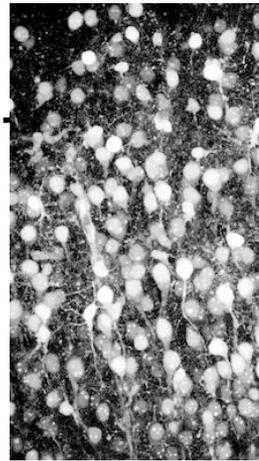
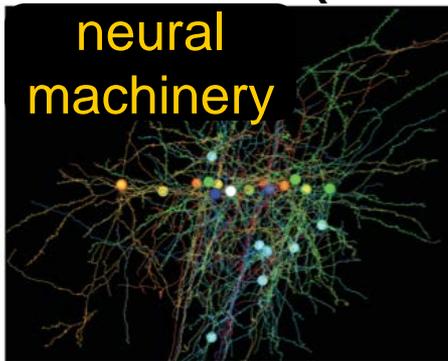
BRAIN Workforce Development



# Multi-scale Integration

Patterns of signaling  
at the **neural** level

Emergent properties at the **circuit**  
level – dynamical variables



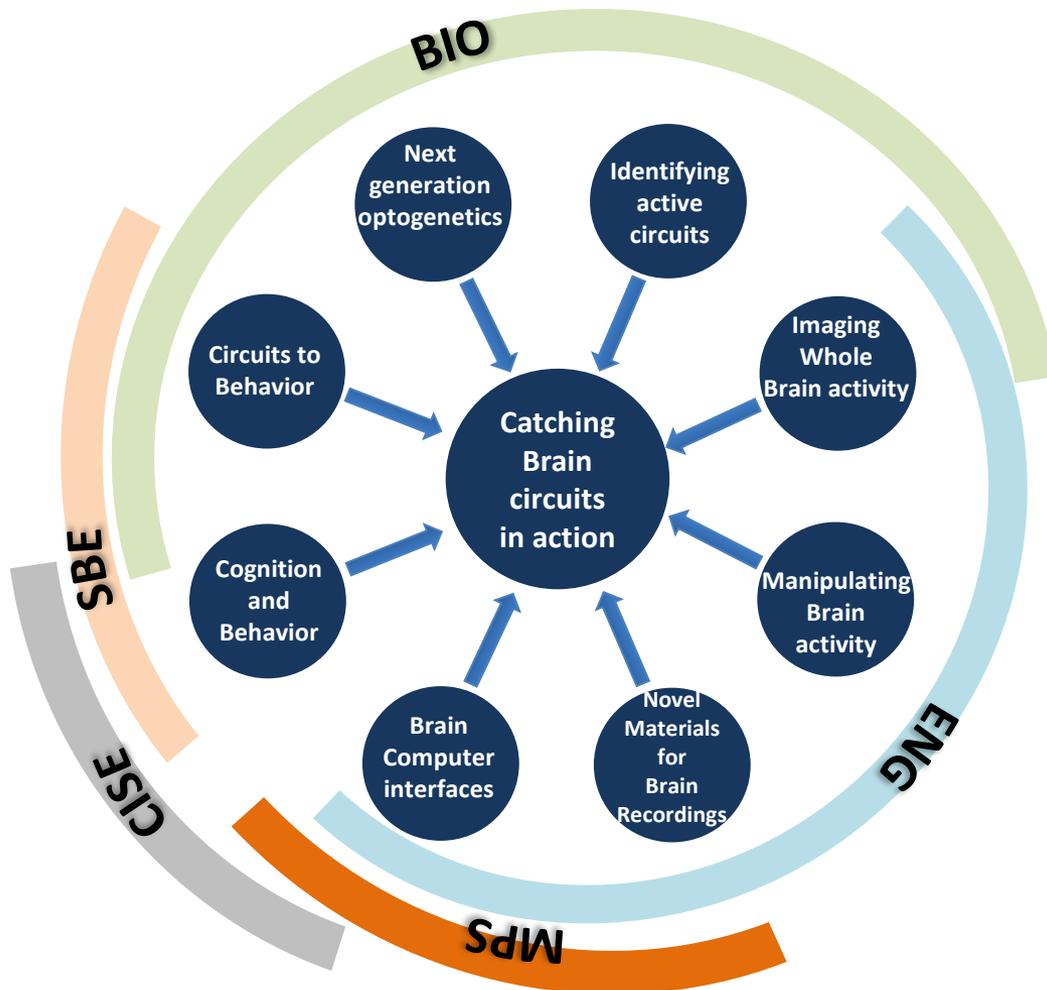
computational  
function,  
systems, theory

*families of questions form continua;  
we don't answer any one of these  
questions in isolation of the others*

Linking dynamics of circuit  
activity with **brain function**  
and **behavior**

# NSF BRAIN Initiative – BRAIN EAGERs

*Leveraging advances across disciplines towards a unified understanding of brain function*



- Ongoing core investments augmented by new funding for the BRAIN Initiative
- Funded 36 EAGER awards responding to call for “Catching Circuits in Action”



# NSF BRAIN Initiative – Special Solicitation

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## *Neuroengineering and Brain-Inspired Concepts and Designs*



- technologies for imaging, sensing, recording, or affecting real-time brain activity and behavior
- computing paradigms
- brain-computer interfaces
- augmented and adaptive systems
- other computational and bioengineered systems



# NSF BRAIN Initiative – Special Solicitation

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## *Individuality and Variation*

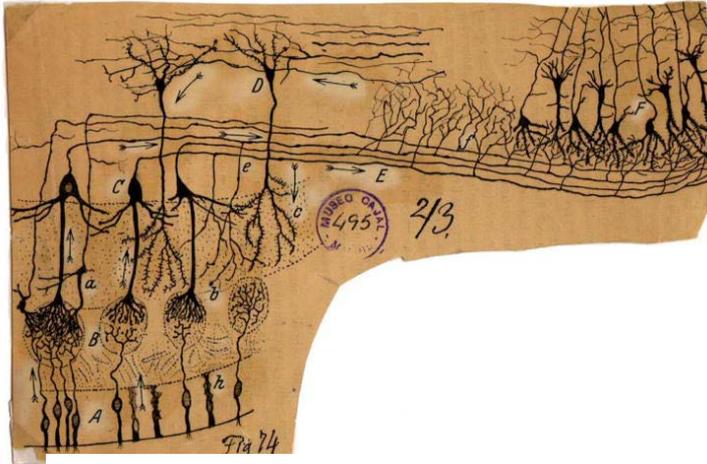
characteristic of all neural and cognitive processes:

*biological/machine systems    signaling/communication  
representations    learning/adaptation    development    resilience  
ability    cultural/social processes    group differences*

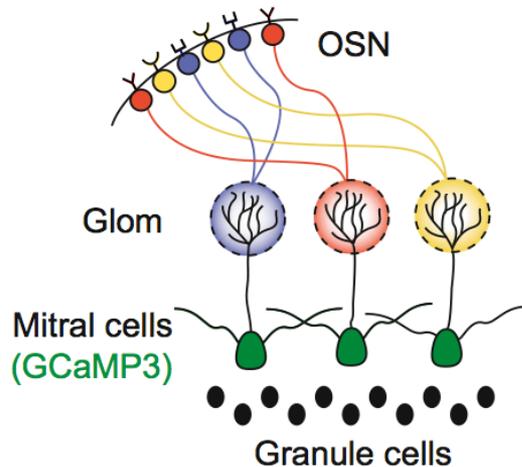
- functionally important individuality and variation
- role of noise
- domain-general statistical and modeling challenges
- explore, describe, and understand the role of naturally occurring variability



# NSF BRAIN Initiative – Ideas Lab



- Intensive workshop to generate innovative and transformative solutions to grand challenge problems
- Neuroscientists, physicists, mathematicians, engineers to solve:
  - encoding of complex odor stimuli
  - how representations are modified
  - influence of innate and learned valence
  - effects of performance limits



Kato et al. (2012)



# NSF Strategies

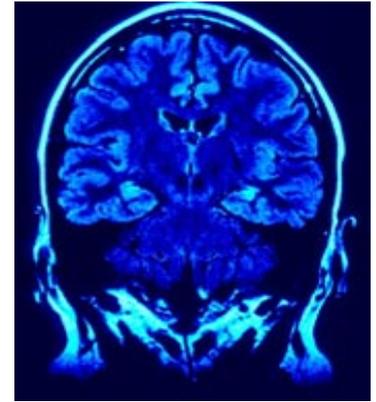
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- Foster **integrative research** that crosses scales, levels of analysis, and disciplines
- Expand investments in **innovative technologies**, experimental and analytical methods, and data and cyber-infrastructure that will enable integrative research
- Support growth of a **globally competitive scientific workforce**

# Future Plans and Opportunities

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- Continued investments in research supporting the development of neurotechnologies to capture brain circuits in action
- Combining predictive theoretical models and innovative experimental methodology for multi-scale integration of neural activity underlying behavior
- Advancing data infrastructure, sharing and interoperability in neuroscience
- Broadening participation in research and educational activities stemming from the BRAIN Initiative and the development of a BRAIN-ready workforce
- International and Interagency opportunities





## Understanding the Brain

NSF's goal is to **enable scientific understanding of the full complexity of the brain, in action and in context**, through targeted, cross-disciplinary investments in research, technology, and workforce development.

**NSF** National Science Foundation  
WHERE DISCOVERIES BEGIN

QUICK LINKS

SEARCH

HOME FUNDING AWARDS DISCOVERIES NEWS PUBLICATIONS STATISTICS ABOUT NSF FASTLANE

## Understanding the Brain

New techniques reveal the brain's complexity.

Credit: Deisseroth Lab

HOME FUNDING BRAIN INITIATIVE EVENTS VIDEO RESOURCES

**Understanding the Brain** – NSF's goal is to enable scientific understanding of the full complexity of the brain, in action and in context, through targeted, cross-disciplinary investments in research, technology, and workforce development. *Understanding the Brain* activities promise innovative and integrated solutions to challenges in our ability to predict how collective interactions between brain function and our physical and social environment enable complex behavior. NSF's strategic investments will support research and infrastructure designed to transform our view of who we are and how we relate to and interact with each other and our ever-changing environment.

NEWS LATEST TWEETS

