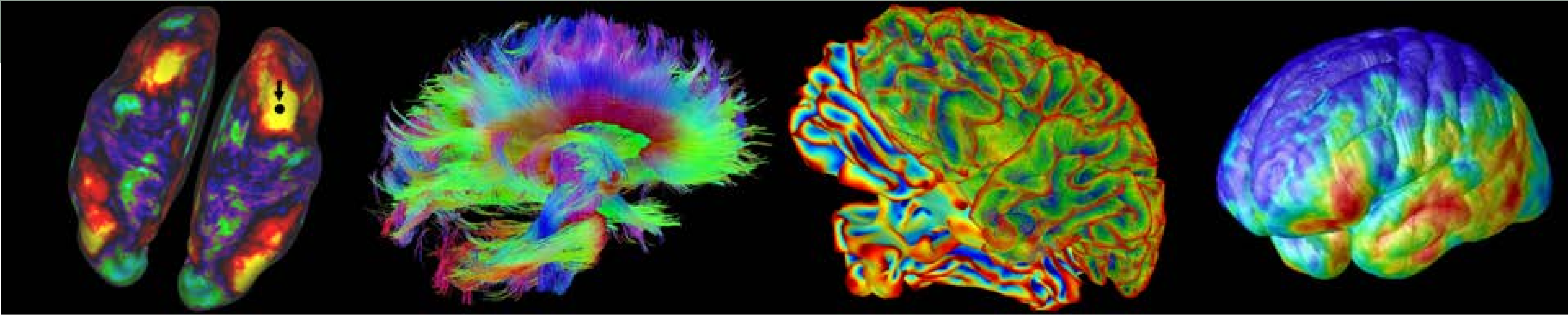


RFA-EB-15-006

FUNDING OPPORTUNITY ANNOUNCEMENT

INFORMATION TO APPLICANTS

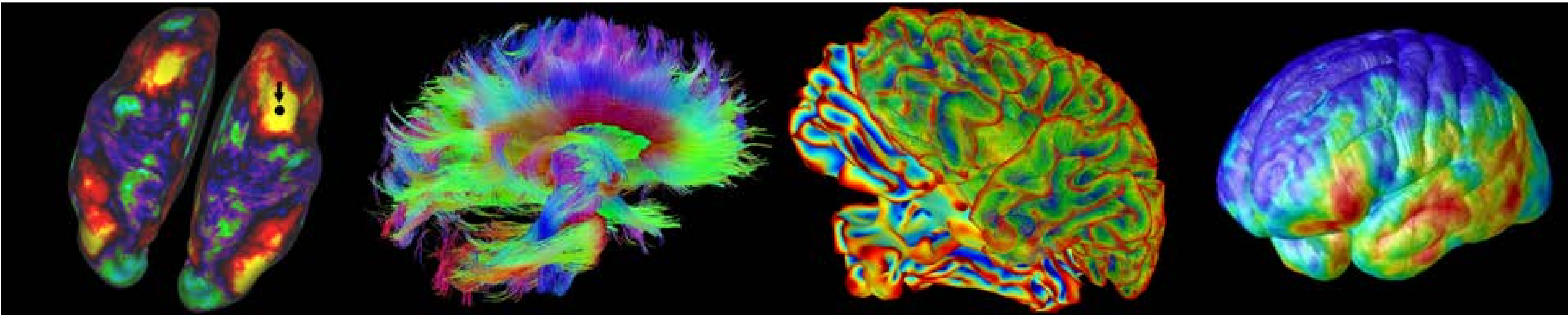
BRAIN Initiative: Theories, Models and Methods for Analysis of Complex Data from the Brain (R01)

Application Receipt date: October 21, 2015

Overall Goals:

- To develop analytical tools for understanding brain function from complex neuroscience data
  - Develop **Theories** to organize/unify data and infer general principles
  - Develop Mathematical/statistical **models** to drive testable hypothesis
  - Develop **Methods** for complex data analyses and feature detection
- Develop tools that can be used by the larger neuroscience community

- Contact: BRAINTheoriesFOA@mail.nih.gov



Tips to Applicants

1) Look at the bullets in Section I of the guidelines
    - Identify topics that resonate with your proposed project (see next 3 slides)
2) Describe the research being proposed for the selected topics
    - What are the theories, models or methods being developed?
    - Can these tools be used to facilitate other projects beyond your own?
3) Form highly interactive partnerships that strongly integrate truly diverse expertise
    - Include theorists, modelers, data scientists, experimentalists and end users
    - Written in research plan section of application, in the biosketches and budget justification
4) Experimental data collection is not expected
    - Only limited, justifiable data collection is allowed for validation
5) Read Section IV requirements very carefully!!

http://grants.nih.gov/grants/guide/rfa-files/RFA-EB-15-006.html

Theories, ideas and conceptual frameworks

- Theoretical insights into how circuit dynamics depend on the properties of single neurons and their connections. Identify conditions for which insights from small circuits scale to larger circuits. Determine which general rules of circuit function depend on specific biological details of neuronal, non-neuronal and synapse function.
- Theories of how information is encoded in the chemical and electrical activity of neurons to implicate behavior in both short and longer time scales.
- Theories of how ensembles of activity can produce collective state conditions and processes with emergent properties beyond the individual units of activity.
- Theories of how ongoing ensemble activity carries out effortful, deliberate cognitive processes requiring multiple or iterative steps, such as mental imagery, mental spatial navigation, mathematical processing, reasoning, or other cognitive abilities that are specially advanced in humans.
- Theories of how interactions within and between large neural systems and brain areas—encompassing inputs from multiple sensory systems, internal states, memories, goals, constraints, and preferences—drive behavior in humans and animals, including specialized animal models.

Models and the associated statistical, analytical and numerical methods to integrate information across large temporal and spatial scales in the nervous

- Models and methods that integrate knowledge across multiple levels - connecting cellular properties with anatomical constraints, physiology, and behavior; linking mechanisms of neural activity with biophysical mechanisms; bridging mesoscale neural circuits with macroscale neural populations.
- Models of collective neuronal activity on spatial scales that span individual synapses, neurons, circuits, networks and systems; developing theories of dynamical activity that span timescales of synapses, action potentials, network activity (including attractors and persistent activity) and internal circuit states (including neuropeptides and neuromodulatory systems).
- Formal statistical inference frameworks to conduct network connectivity and causal-inference analyses from different types of neuroscience data such as fMRI, EEG, LFP and multi-site single neuron recordings.
- Uncertainty quantification of the data, parameters and outcomes of predictive multiscale models of the brain, e.g. as a result of sparse data and biological variation across subjects.
- New, interoperable simulation methods for multiscale models; e.g. to couple subcellular to the neuronal networks, to full-brain model scales.

New methods for complex data analysis

- Methods to extract fundamental features from large nonlinear, spatio-temporal data sets, including real-time data analysis, e.g. from physiological, behavioral and imaging data.
- Novel implementations of dynamic versions of principal component analysis, including novel implementations of independent component analysis, graphical models and compressed sensing that may be used to dynamically track structure in continuous data, point process data, and combinations of the two.
- Tools to address data dimensionality – correlating lower dimension neural activity among subsets of strategically sampled neuronal populations; analyzing higher dimension data resulting from increased behavioral and stimulus complexity.
- Data fusion and data assimilation methods to combine heterogeneous data and link sparse data with mechanisms.

To be presented to reviewers during reviewer orientation

PROGRAMMATIC ISSUES OF RFA EB-15-006

Significance

Specific Topics of Interest (bullets from Section I)

http://grants.nih.gov/grants/guide/rfa-files/RFA-EB-15-006.html

- Written to stimulate new analytical tools to understand the brain
- Bullets are pushing very difficult challenges

Special REVIEW CRITERIA

- Have the investigators taken up one of these challenges, or something similarly challenging?
- To what degree will the proposed analytical tools be widely used in the neuroscience community, and/or will they have a strong influence on fundamental approaches to understanding neuroscience data?

Investigators

Special REVIEW CRITERIA

- To what degree have the roles of the collaborating end users been described?
- To what degree is there an appropriate effort to collaborate with theorists, modelers, data scientists, experimentalists and end users for developing tools for the wider community, and are the roles of each expert clearly delineated?
- Will the end user contributions to the project add substantive value to the project deliverables?
- To what extent will the project inform experimental paradigms and drive future data collection?

Approach

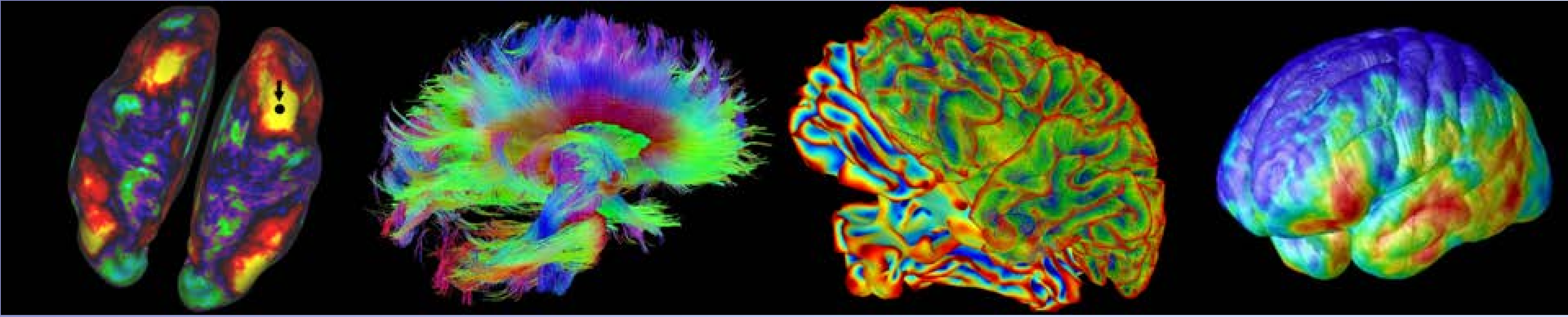
Special REVIEW CRITERIA

- To what degree does the application propose adequate metrics and strategies for building confidence in the analytical tool, and their predictive capabilities for the intended domain of use?
- To what degree are the end deliverables clearly defined and/or quantifiable?
- Are the source data for analysis appropriate to the project and readily available for replication studies?
- Are the use cases for the proposed tools well described and appropriately understood in terms of end user needs?

Tool Sharing

Special REVIEW CRITERIA

- Does the Tool Sharing Plan include appropriate detail on modules, parameters and datasets?
- Does the plan adequately address documentation, validation and tool reproducibility?
- Does the Software Sharing Plan appropriately address goals for dissemination, free availability for non-profit use and modification, reproducibility and continued development by other individuals or groups, and appropriate customization and/or commercialization?



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QUESTIONS?