

Big Ideas in Neuroscience

*Stanford
Neurosciences
Institute*

Stanford
University



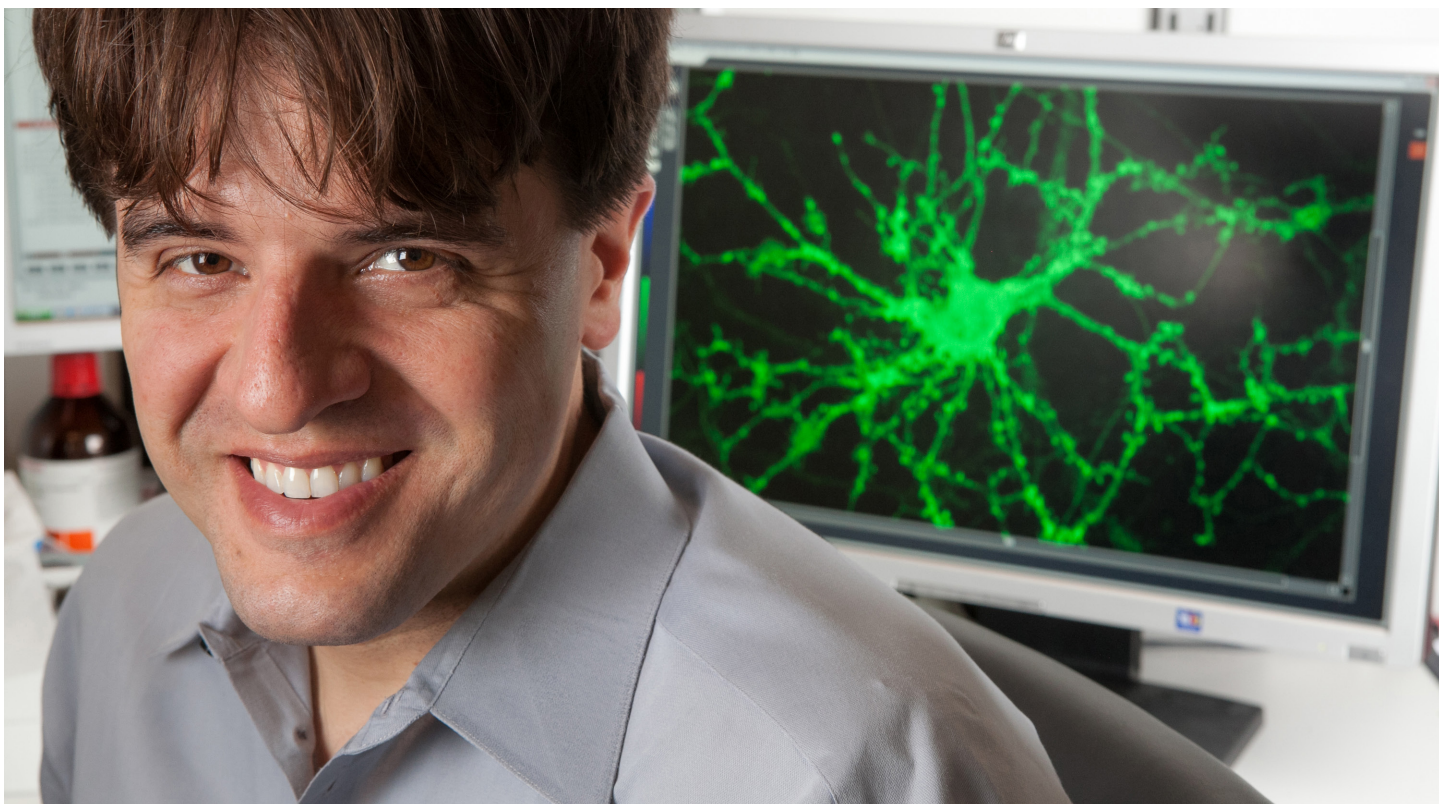
Big Ideas in Neuroscience

Stanford Neurosciences Institute

The human brain—a three-pound mass of nerve and glial cells—remains one of the greatest mysteries in science. This complex living structure controls every aspect of our mental lives: perception, movement, speech, memory, reasoning, pain, and even imagination. Yet we are only now beginning to unravel some of its deepest secrets.

Understanding how billions of cells are connected in neural circuits, and how these circuits give rise to mental activity and behavior, has enormous potential. It can change the way we treat neurological and psychiatric disorders. It can help us better understand our thoughts, emotion, creativity, decision making, and morality. By enhancing our abilities and potential, it may even shape who we will become in the future.

In short, neuroscience has the potential to transform the 21st century. This is why Stanford established a new campus-wide interdisciplinary institute for brain research. And this is also why the Stanford Neurosciences Institute is launching *Big Ideas in Neuroscience*, a major initiative to foster transformative research in brain sciences. We are seeking visionary philanthropists who will join Stanford President John Hennessy and Provost John Etchemendy to advance highly interdisciplinary neurosciences research—and revolutionize our understanding of the human brain.



KARL DEISSEROTH, THE D. H. CHEN PROFESSOR OF BIOENGINEERING AND OF PSYCHIATRY AND BEHAVIORAL SCIENCES. DEISSEROTH WAS RECENTLY AWARDED THE 2014 KEIO MEDICAL SCIENCE PRIZE FOR HIS WORK ON OPTOGENETICS AND NEURAL CIRCUITRY.

WHY NOW?

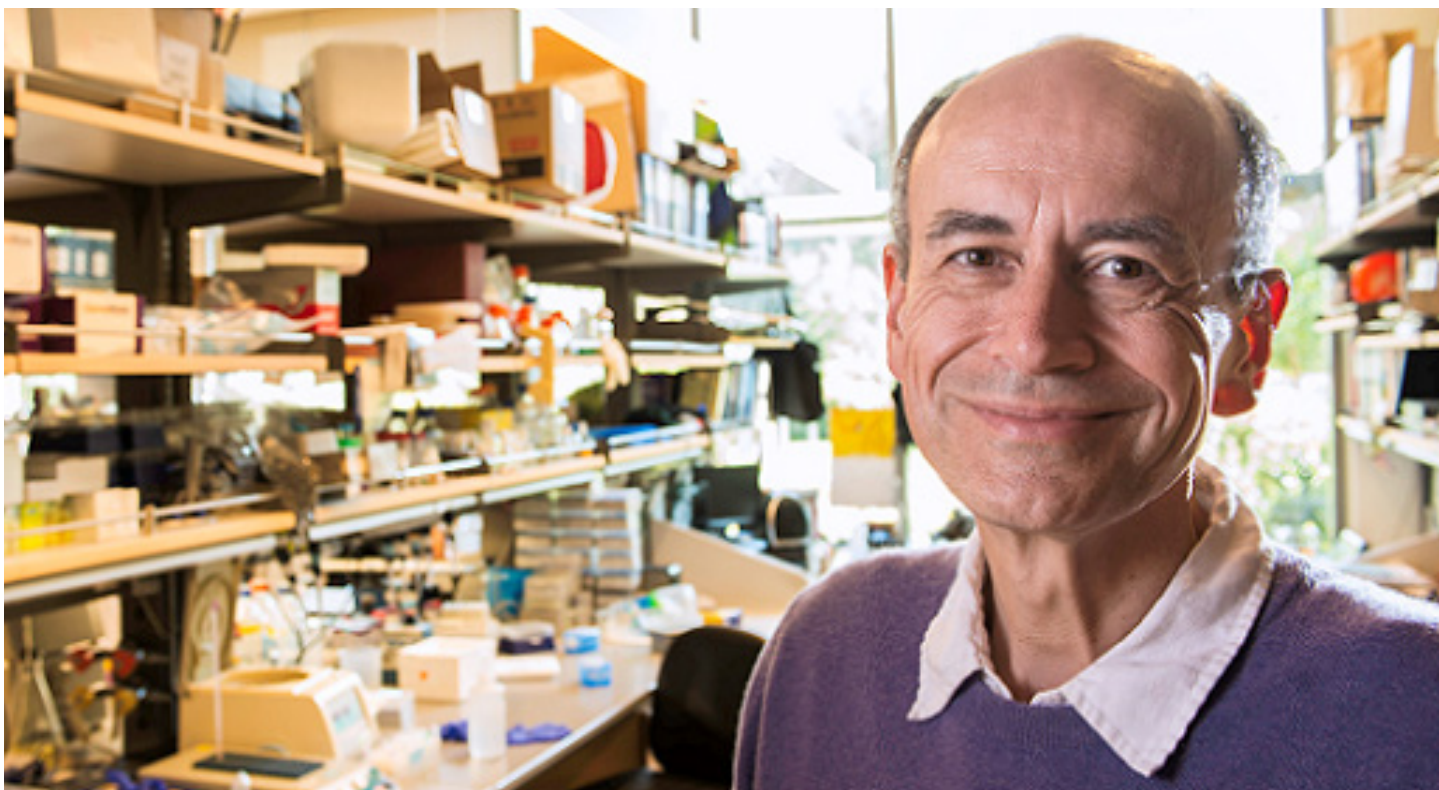
Our ability to better understand the brain will have transformational impact on individuals and families across every aspect of life—in brain health and recovery, how we learn, how we age, how we make decisions, and many other areas.

Over the past two decades, landmark advances have given us new tools and techniques to observe and even tune activity within a living brain. The sequencing of the human genome, revolutionary imaging technologies, discoveries in nanoscience and physics, optogenetics—these breakthroughs are to neuroscience what the telescope was to astronomy. Many of these advances were made here at Stanford.

Brain research is also benefiting from a renewed focus both at the federal and local levels in the United States. President Obama's investment in the BRAIN initiative, alongside efforts at Stanford and other research institutions, are yielding a critical mass of activity.

The timing of this initiative is important for another reason: As our society ages, brain-related disorders such as Alzheimer's and Parkinson's are taking an increasing toll on individuals around the world. New knowledge is needed to treat neurological and psychiatric disorders and lessen their impact on individuals, families, and society. The time has come to develop better therapies and methods of preventing these devastating health problems.

We also need to understand the workings of the brain to better know who we are: our thoughts, emotions, creativity, and morality. This important endeavor requires an interdisciplinary research community who will draw from and transform a multiplicity of disciplines, including neurosciences, medicine, education, law, and business. Discoveries will remodel our understanding of brain.



THOMAS SÜDHOF, THE AVRAM GOLDSTEIN PROFESSOR IN THE SCHOOL OF MEDICINE AND A STANFORD NEUROSCIENCES INSTITUTE AFFILIATE, WAS AWARDED THE 2013 NOBEL PRIZE FOR HIS WORK ON CELL PHYSIOLOGY.

WHY STANFORD?

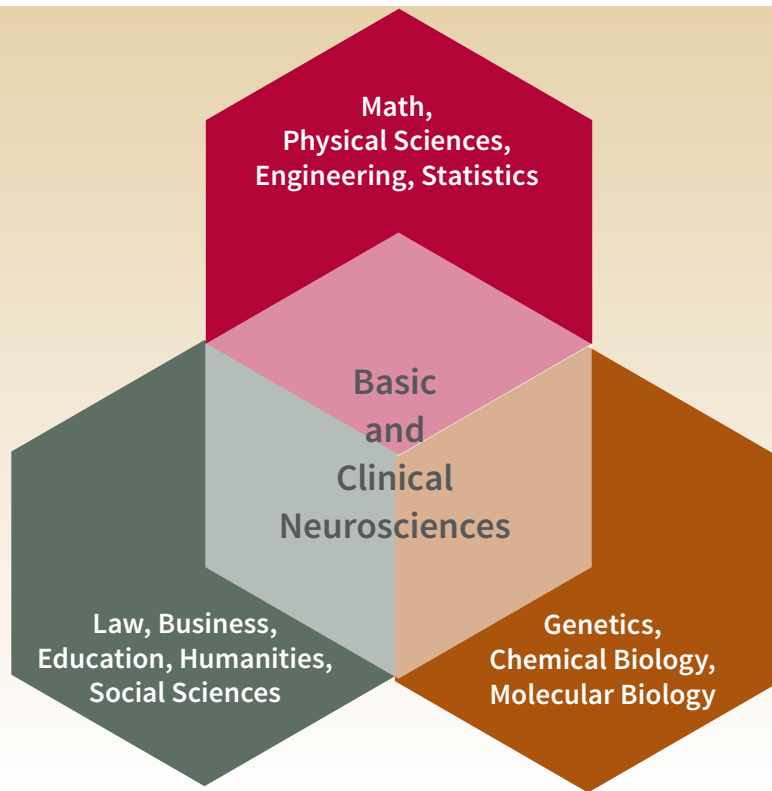
Stanford is uniquely positioned to lead the kind of interdisciplinary research required—indeed, no other institution has a better track record.

Already, the university has built successful research initiatives around the biosciences—such as Stanford Bio-X, which serves as a model for other programs worldwide—and successfully launched programs in the environment, energy, international affairs, and the arts. The university is poised to create the same powerful synergies around brain research.

Neuroscience is now one of the strongest and most prolific areas of inquiry at Stanford, engaging approximately 200 faculty members. These scholars bring expertise in fields that range from cell biology to psychology, from bioengineering to education, from neurology to the social sciences, and from computer science to business.

In April 2013, with the endorsement of deans and faculty across the university, President Hennessy appointed William Newsome, the Vincent V. C. Woo Director of the Stanford Neurosciences Institute, Harman Family Provostial Professor, and professor of neurobiology, to lead Stanford's interdisciplinary efforts in the neurosciences. Nearly simultaneously, Professor Newsome was enlisted to co-lead the National Institutes of Health planning group for President Obama's BRAIN initiative.

The new Stanford Neurosciences Institute was launched in September 2013. This institute is leveraging Stanford's existing strengths: its top-caliber faculty and students, its contiguous and nimble campus environment, and its entrepreneurial, creative culture.



THREE STRATEGIC RESEARCH INTERFACES FOR THE STANFORD NEUROSCIENCES INSTITUTE: THE BASIC AND CLINICAL NEUROSCIENCES FORM THE CENTRAL CORE, WITH IDEAS, TECHNIQUES, STUDENTS, AND FACULTY MOVING FLUIDLY ACROSS THE BOUNDARIES.

Stanford's faculty includes:

- 21 living Nobel laureates
- 20 National Medal of Science recipients
- Two National Medal of Technology recipients
- 277 members of the American Academy of Arts and Sciences

GOALS OF THE INSTITUTE

By transcending traditional boundaries of research, the Stanford Neurosciences Institute is accelerating new discoveries in the human brain. The goal is to employ this knowledge to enhance human potential and alleviate suffering. The institute seeks to address a myriad of real-world problems in areas as diverse as medicine, education, law, and business, such as:

- Tuning brain patterns to treat depression
- Addressing legal questions about people's mental state
- Creating prosthetic limbs that can be controlled by the brain
- Restoring sight and hearing
- Understanding how the brain learns
- Enhancing memories in Alzheimer's patients



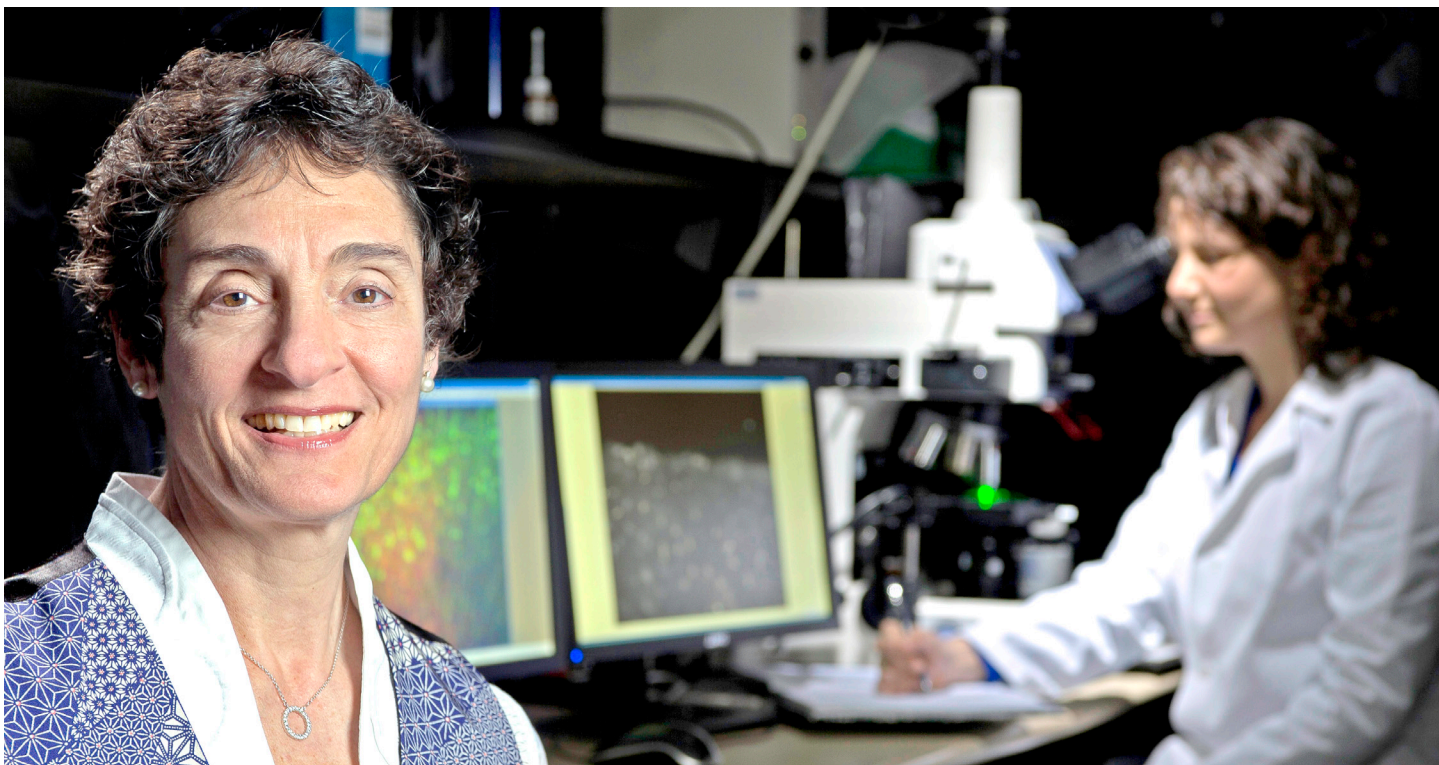
WILLIAM T. NEWSOME, DIRECTOR OF THE STANFORD NEUROSCIENCES INSTITUTE, HARMAN FAMILY PROVOSTIAL PROFESSOR, AND PROFESSOR OF NEUROBIOLOGY

BIG IDEAS IN NEUROSCIENCE

Achieving our mission will require the collaboration of top scholars, working together to pursue complex research projects. That is why the institute has launched a bold new program: *Big Ideas in Neuroscience*. In response to an initial call for proposals, faculty from across the university have formed interdisciplinary teams of 20 or more researchers across many departments. They have generated exciting new ideas—sometimes quite radical ideas—for investigating long-standing problems in the science of the brain.

Each *Big Idea* already has demonstrated early promise. However, the goals, concepts, and techniques at the heart of the *Big Idea* projects are so cutting-edge that they are not yet candidates for federal funding or outside research grants. This is the stage at which many interdisciplinary research projects falter—and is why the *Big Ideas* program is so vital.

“The *Big Ideas* program has already resulted in genuinely new collaborations among Stanford faculty, unleashing great energy and creativity. Now we want to empower these new teams to do breakthrough research at important interdisciplinary boundaries that are critical to neuroscience,” says Newsome.



CARLA J. SHATZ, THE SAPP FAMILY PROVOSTIAL PROFESSOR, THE DAVID STARR JORDAN DIRECTOR OF STANFORD BIO-X, AND PROFESSOR OF BIOLOGY AND OF NEUROBIOLOGY

MAJOR RESEARCH TRAJECTORIES

Big Ideas in Neuroscience aims to foster innovative collaborations through early stage funding. The research is centered around three major themes: **NeuroDiscovery**, **NeuroEngineering**, and **NeuroHealth**. Within those themes, Stanford leaders have selected seven research paths for funding:

NeuroDiscovery initiatives probe the inner workings of the brain. These include efforts to understand decision making; to explore technology to modulate brain activity, which may help treat mental health conditions; and to apply optical technologies to neuroscience, which will allow scholars to visualize the brain in unprecedented detail.

- NeuroChoice
- NeuroCircuit
- NeuroVision

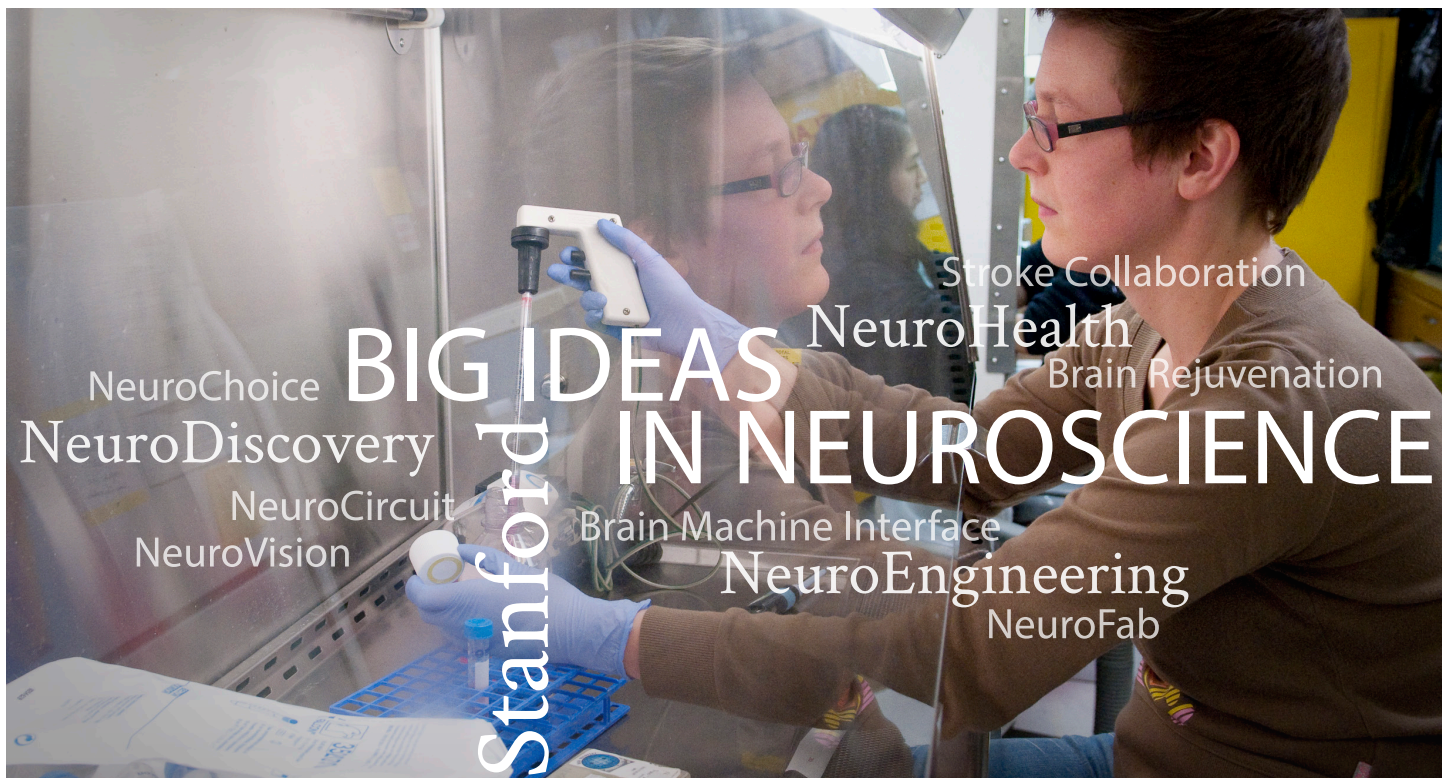
NeuroEngineering initiatives tap into Stanford's engineering faculty to create innovative technologies that will work in tandem with the brain. One example is intelligent prosthetics. Another initiative is a new incubator that brings together engineers and nanotechnology experts with neuroscientists.

- Brain Machine Interfaces
- NeuroFab

NeuroHealth initiatives create collaborations to translate neuroscience discoveries into treatments. These include a new center for brain rejuvenation, focusing on maintaining and regenerating the brain's capacities, and new research on stroke, working toward novel therapies and better recovery.

- Brain Rejuvenation
- Stroke Collaborative Action Network

These projects have the potential to dramatically increase our understanding and treatment of the brain in health and disease. An infusion of support is now essential to unleash the creative energies of our faculty and students and take these initiatives to the next level.



CASE FOR SUPPORT

President Hennessy and Provost Etchemendy are looking for visionary philanthropic individuals to join them in advancing *Big Ideas in Neuroscience*, the highest priority research initiative of the Stanford Neurosciences Institute.

Stanford leadership has already invested significant pilot funding in several of these projects. Generous philanthropic support is now needed to realize the extraordinary potential of this research. The Stanford Neurosciences Institute has a goal of raising \$35 million in expendable funding within the next several years for the *Big Ideas in Neuroscience* research initiative.

Philanthropic investments made now will enable Stanford to advance the most promising of the initial seven *Big Ideas* projects to the next level, expanding research in specific areas for an additional five years with the goal of producing pioneering innovations in brain health. The institute will also launch another set of new *Big Ideas* during the same time frame, creating even more opportunities for discovering how the brain works and how to treat and prevent brain disorders.

IN CONCLUSION

The emerging interdisciplinary study of the brain presents both challenges and opportunities far beyond what we can imagine now. This is precisely what excites us at Stanford. We anticipate that an investment at this early juncture will create significant momentum and advance groundbreaking research in neurosciences, with tremendous benefits to individuals and society. Expendable gifts in the \$1 million to \$10 million or more range (payable over five years) would provide the vital financial support necessary to drive innovative brain research forward and improve lives.

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