Written Statement
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Subcommittee on Commerce, Justice, Science, and Related Agencies
Appropriations Committee
In Support of FY2017 Appropriations for the National Science Foundation

Mr. Chairman and members of the Subcommittee, my name is Hollis Cline and I am privileged to offer this testimony in support of increased funding for NSF for FY2017. I offer this testimony in my capacity as president of the Society for Neuroscience (SfN). I am also the Chair of the Department of Molecular and Cellular Neuroscience and the Director of the Dorris Center for Neuroscience, as well as Hahn Professor of Neuroscience in the departments of Molecular and Cellular Neuroscience, and Chemical Physiology at The Scripps Research Institute in La Jolla, CA. My research focuses on determining how the mechanisms sensory if experience affects the brain's structure, development, and function.

The Society stands with others in the research community in requesting at least $8 billion for NSF for FY2017. Funding at this level will put science on a path to take advantage of the remarkable scientific opportunities made possible by emerging tools and technologies. NSF-funded basic science research is central to discovering new approaches to advance the health and well-being of all Americans. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other institutions. The agency supports 25 percent of basic science research at U.S. colleges and universities and helped produce 217 Nobel Prize recipients since 1952; it is critical we continue fostering this potential. In addition, sustained and dependable growth fuels an ecosystem that drives economic development and provides a path forward for a new generation of researchers, committed to advancing public health and well-being.

SfN's mission is to advance understanding of the brain and nervous system. We believe this understanding occurs through a better and deeper understanding of basic science. Given the tremendous human and economic toll of brain disorders worldwide—including autism, depression, schizophrenia, multiple sclerosis, Parkinson's disease, and Alzheimer's disease—neuroscience is among those areas of research in which continued progress is most powerfully needed. SfN leads efforts to disseminate and discuss emerging neuroscience discoveries, hosting one of the world's largest annual scientific meetings and publishing two leading scientific journals. SfN is also committed to actively educating the public about the brain, both in health and in illness, and to engaging policymakers regarding the tremendous progress and potential of brain research.

On behalf of the nearly 40,000 members of SfN, thank you for your past support of the NSF and of neuroscience research. Thank you also for your continued support and investment in NSF's Understanding the Brain project, which includes the Foundation's contribution to the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. As one crucial part of the federal investment in neuroscience, NSF-funded BRAIN programs fuel future discoveries across many areas of neuroscience and other research disciplines as well.

Cross-Disciplinary Neuroscience

Now entering its third year, the BRAIN Initiative continues to push cross-disciplinary research in neuroscience, drawing on knowledge from the life sciences, physical sciences, and engineering. Still in its early stages, the BRAIN initiative is beginning to produce the types of foundational discoveries that will have broad application across the field. Continued investment in the BRAIN initiative, as well as NSF-funded neuroscience efforts in general, will undoubtedly lead to game-changing technologies to help us better understand the complexities of the brain.

The following examples are just a few of the many basic research success stories in the science of the brain emerging thanks to interdisciplinary research funded by a strong historic investment in NSF and other research agencies.

Repairing the Brain

My own research investigates how an injured brain could be repaired to address conditions such as glaucoma and brain damage. I look to mechanisms involved in brain growth and development for possible answers and treatments. In order to understand how the brain grows and matures, I study how input from the body's senses affects the development of the brain structures and function. For example, my work looks at the visual systems in tadpoles to study how sensory system stimulation can help trigger the birth of new cell growth patterns, which can change the trajectory of the growing brain. Future research in this field will attempt to use these genes and pathways related to neuronal growth to better understand how the brain may be able to heal itself.

Seeing the Brain as Never Before

New advancements in brain imaging technology are vital for advancing the field of neuroscience. A transformative method, called CLARITY, makes the whole brain transparent, allowing researchers to view the brain in a way that has never before been possible. The brain is normally covered in an opaque tissue that obstructs the ability to view structures deep within. Because of this, neuroscience research typically depends on viewing cross sections of the brain or using brain imaging to reconstruct neural networks. CLARITY allows for views within the whole brain by applying a gel that removes the opaque tissue postmortem. In this way, researchers can view the brain's intact structure and circuitry without interrupting its biochemistry. This technique also allows researchers to view 3-D views of brain networks. This NSF-funded technology is a tool that will continue to be used by researchers for numerous future discoveries. CLARITY will allow for greater understanding of normal brain function, and will also allow for in-depth study of disease states. Since the original publication of the method in 2013, CLARITY has already been used to study Alzheimer's disease, autism, multiple sclerosis, and other important topics. CLARITY will continue to serve as cutting edge tool for scientists interested in understanding brain networks in neurological disorders.

Observing Living Neurons

Imagine being able to see exactly which cell is firing in a brain during a specific behavior or in response to a specific stimulus. An NSF-funded brain imaging tool allows researchers to do exactly that. This technology, a two-photon microscope, allows investigators to observe neural activity in living animals and see which individual neurons fire in response to a specific stimulus or behavior. This new imaging technology will help advance understanding of brain circuitry in both the healthy brain and in various disease states.

This research was funded by NSF's Early-Concept Grant for Exploratory Research (EAGER). EAGER supports high-risk high-reward research that is in very early stages and has the potential to lead to a transformative discovery. The EAGER funding for this project was made through the cross-agency BRAIN Initiative, which seeks to develop new technologies to study the brain. The two-photon microscope is the type of technology creation that will enable numerous other researchers to study the brain to learn more about how the healthy brain works and the effects of disease on the brain.

Spurring Innovation by Investing in Neuroscience

Through NSF, we are continually increasing our knowledge about the inner workings of the brain, including non-invasive methods for imaging the human brain and understanding the potential link between human and computer cognition. Progress in these areas is critical to helping us address the neurological and psychiatric diseases that strike over 100 million Americans each year, costing hundreds of billions of dollars annually. Likewise, the spectrum of brain injuries requires the development of new tools and technologies that create a better foundational understanding of the brain.

Neuroscientists investigate solutions to some of the most vexing questions facing science, such as allowing those who are paralyzed to move through world using their thoughts via brain-machine interfaces and learning more about brain function by observing real-time communication between living neurons in jellyfish. NSF is uniquely positioned to address these hurdles because of its emphasis on integrative and interdisciplinary research and its long history of funding research that leads to the development of life-changing neurotechnologies.

NSF provides critical support to those at all stages of their scientific career, from students considering research careers to post-doctoral fellows to senior researchers. And all of them will benefit from the advanced scientific tools and infrastructure made possible through NSF support.

A Foundation for the Future

America's scientific enterprise — and its global leadership — is built on a foundation of scientific understanding and application. Without sustained investment, we could quickly lose that leadership, and our culture of entrepreneurship and curiosity-driven research could be hindered for decades.

To take advantage of the opportunities in neuroscience, we need an NSF appropriation that allows for sustained, reliable and robust growth. We live at a time of extraordinary opportunity in neuroscience. Because of new technologies, and an ever-expanding knowledge base, cross-disciplinary research puts us on the cusp of discoveries not thought possible a generation ago. Those discoveries will build to improved health for the American public and will help maintain American leadership in science worldwide. Thank you for this opportunity to testify.