Written Statement

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House of Representatives Subcommittee on Commerce, Justice, Science and Related Agencies
Appropriations Committee
In Support of FY18 Appropriations for the National Science Foundation

Mr. Chairman and members of the Subcommittee, I am Dr. Eric Nestler and it is my honor to present this testimony in strong support of $8 billion in funding for the National Science Foundation (NSF) for FY18. I am offering this testimony in my capacity as President of the Society for Neuroscience (SfN). I am the Dean for Academic and Scientific Affairs at the Icahn School of Medicine at Mount Sinai, where I am also the Director of the Friedman Brain Institute and professor of neuroscience, pharmacological sciences, and psychiatry. My laboratory studies the molecular mechanisms of drug addiction and depression in animal models, a critical topic given the current crisis around opioid addiction across the U.S., stress-related disorders, and suicide among our nation's Veterans.

SfN stands with the scientific research community in requesting at least $8 billion for NSF for FY2018. Funding at this level will allow for the development of new tools and technologies to advance the study of neuroscience, as well as allow for the investments needed in basic science to bring about the next breakthroughs in the health, education, and well-being of all Americans. Additionally, reliable federal investment is needed to further drive economic development and provide a path for a new generation of researchers committed to advancing the nation's public health. Continued investment at the National Science Foundation will allow scientists to continue this work and will help ensure that young researchers continue to see promise in a career in research.

NSF funding is also a critical part of the research conducted at nearly 2,000 colleges, universities, and research institutions in all 50 states. In fact, funding from NSF supports a quarter of basic research at colleges and universities, and has supported 217 Nobel Prize recipients since 1952.

On behalf of the nearly 37,000 members of SfN, thank you for supporting NSF and investments in neuroscience. Basic research in neuroscience is a critical function of the federal government as it builds the foundation for advancements in public and individual health, higher education, and workforce development. We are also appreciative of the Committee's support for NSF's participation in the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. This small but targeted portion of the overall federal investment in neuroscience will help develop the tools we need to look more deeply into the brain to map functions for a plethora of future applications.

Advancements in our understanding of the brain and nervous system rely on continued discoveries and the development of the tools that will drive tomorrow's discoveries—both of which rely on support from the federal government. The deeper our grasp of basic science, the more successful those focused on clinical and translational research will be. We use a wide-range

of experimental and animal models that are not used elsewhere in the research pipeline. These opportunities create discoveries – oftentimes unexpected – that expand our knowledge of biological processes at the molecular, cellular, and brain circuit levels.

SfN believes strongly in the research continuum. Basic science is the foundation of clinical innovations, which lead to advances in treatments that impact the public's health. Given the tremendous human and economic toll of brain disorders worldwide—including autism, depression, schizophrenia, multiple sclerosis, Parkinson's, and Alzheimer s disease—neuroscience will play a key role in protecting and improving our quality of life.

As the leading scientific society dealing with the brain and nervous system, SfN works proactively to inform lawmakers, stakeholders, and the public of advancements in neuroscience and the impact that science can have in reducing the burden of diseases of the brain. In addition, we host one of the largest annual scientific meetings—held this year in Washington D.C. in November 2017—and publish two highly-rated scientific journals. Some recent, exciting advancements in brain research are listed below for your review.

The Impacts of Neuroscience Research

Understanding the Relationship Between Genes and the Brain

My own research investigates the links between neuropsychiatric disorders and the changes in gene expression that occur over a lifetime (epigenetics). These epigenetic changes can be influenced by life experiences, including exposure to stress, drugs of addiction and natural factors like hormone cycles. My lab seeks to understand how these epigenetic mechanisms lead to life-long changes in brain function in disorders such as depression and drug addiction, and provide new routes of investigation for possible treatment. For example, my work looks at how the regulation of key genes in single brain regions affect the expression of a network of other genes, which underlie an individual's susceptibility versus resilience in neuropsychiatric disorders. In particular, we study how gene regulation changes susceptibility in response to chronic stress or drug exposure in mice and depression or addiction in humans. In identifying new molecular and genetic mechanisms that underlie these complicated disorders, we are now working to advance these discoveries into new and more effective treatments. This work is possible today due to transformational methodological tools in basic genetics developed by NSF-funded research over the past five to ten years, which underscores the broad benefit of basic, fundamental research to the U.S. biomedical effort.

Making New Brain Technology Affordable and Portable

Technology that allows the brain to connect directly to computer interfaces (brain computer interfaces, or BCIs) displays the dramatic advances made in neuroscience over the last decade. BCIs have led to exciting new treatments for stroke and spinal cord injury patients by pairing them with electrical stimulation. In this way patients can begin to regain control of muscles, providing recovery of some lost motor abilities. However, these technologies remain primarily confined in labs due to the expense and bulk of the equipment needed, preventing patients from using them consistently and often. To try to make these treatments more accessible,

scientists funded by the NSF created portable, inexpensive devices that could make these BCIs practical for home use. They were able to design a system that could successfully detect and decode brain activity that cost less than $200 to assemble, as well as a second device that could provide electrical stimulation for a mere $50. Both are portable and battery powered, a leap forward in moving these treatments from the lab to the home, leading to improved mobility and quality of life.

Understanding Brain Cell Communication

In order to treat mental disorders affecting millions of Americans and others around the world, we need to understand the basics of how cells communicate to form the underlying networks and systems of the human brain. One of these communication methods is through the release of small proteins called neuropeptides, which often change the activity of nearby cells over long periods of time. The slow response of other cells to the release of small amounts of neuropeptides makes them difficult to study, despite the critical role they play in keeping energy, hunger, and mood stable. Researchers funded by NSF's Understanding the Brain Initiative developed a way to grow small numbers of brain cells in a tube measuring only 350 micrometers wide. In the tube, scientists can stimulate a single brain cell and capture and analyze the neuropeptides it releases while monitoring the responses of other nearby cells. Though this technique was developed using cells from invertebrates, the researchers recently showed that it can also be performed using mammalian cells. This new research method could allow researchers to grow single or small networks of brain cells taken from individual patients to study how their cells communicate differently than healthy cells.

Federal Basic Neuroscience Research: A Key Investment for the United States

Neuroscience, and basic research more generally, is a critical federal investment with implications far beyond health and well-being, including education, national security, and a growing economy. NSF is home to basic research that allows for the kind of scientific discovery that transforms multiple elements of human life. From the most basic discoveries come some of our most successful technologies that improve lives and create new opportunities, industries, and good-paying jobs. The U.S.'s leadership role in neuroscience research also provides a powerhouse of economic development and job creation.

On behalf of the scientists and physicians of the Society for Neuroscience, we thank this Subcommittee for its support and look forward to working with you in the months and years ahead to provide scientific advancements that will benefit your constituents and people around the world. Neuroscience specifically has limitless potential to affect how we work, learn, and play. We ask that you continue to invest in the basic science potential of our nation.