

Diane Lipscombe, PhD, President, Society for Neuroscience
202-962-4000 – Email: advocacy@sfn.org
Subcommittee on Commerce, Justice, Science and Related Agencies U.S. House of Representatives Appropriations Committee
In Support of FY20 Appropriations for the National Science Foundation

Mr. Chair and members of the Subcommittee, I am Diane Lipscombe, President of the Society for Neuroscience (SfN), and it is my honor to present this testimony on behalf of SfN in support of increased funding for the National Science Foundation (NSF), to \$9 billion, for FY20. I am offering this testimony in my capacity as President of SfN, now entering its 50th year, an association of nearly 37,000 neuroscientists from all 50 states and around the world. Our members stand with the broader scientific community in requesting increased funding for NSF in FY20, which will advance understanding of basic brain functions, enable the development of new technologies to study brain function, and catalyze yet unimagined discoveries in neuroscience research. Moreover, SfN urges Congress to provide relief from the draconian cuts set to take effect as a result of the Budget Control Act (BCA). By raising the caps directed by the BCA, Congress can ensure that we do not backslide on previous support for scientific research and discoveries. We also urge the Committee to complete their appropriations work in advance of the September 30 deadline to provide predictability and stability to scientists relying on federal funding to support their work.

As a neuroscience researcher and Director of The Carney Institute for Brain Science at Brown University, I see the impact of federal funding for neuroscience research daily. For example, at Brown University, we are developing new approaches to the brain machine interface, which could dramatically improve the quality of life of individuals who depend on prosthetic devices or who may have restricted mobility, such as paralysis resulting from a stroke or traumatic brain injury. The success of this technically-demanding research, depends on the combined skills of neuroscientists, computer scientists, engineers, neurologists, neurosurgeons and mathematicians, and other disciplines to help those impacted regain movement and independence using brain-controlled technology. Collaboration across scientific disciplines continues to advance new research involving computational neuroscientists, cognitive neuroscientists, and data scientists in the Carney Institute for Brain Science at Brown. This collaboration develops new mathematical approaches for extracting content rich information from large data sets of human brain activity. Computational tools are now essential to neuroscience research as we study massive datasets resulting from the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, including those that map the millions of connections between neurons and enable us to understand high level brain function.

NSF funded research has contributed significantly to transformative scientific discoveries. Notably, since 1952, 217 Nobel Prize recipients were recipients of NSF funding. NSF provides the investments needed in basic science to bring about the next breakthroughs in technology, health, and education toward improved well-being for all Americans. Increasing the NSF budget is thus critical to the continued ability of researchers to make impactful scientific advancements, speed innovative research, and allow for the development of powerful tools to advance our understanding of brain function. As we age, the incidence of brain disease grows at a frightening rate and we must double down on our collective efforts to diagnose and treat them.

Successful, impactful neuroscience research requires collaboration across disciplines and an unbroken series of funding streams, and NSF-funded research allows for some of our most significant scientific achievements. As we take on more and more challenging research problems, for example: “why do neurons die too soon in one in three of people over the age of 65?”, we are increasingly dependent on new tools to help us examine aging human brains without causing damage. These endeavors depend on support from the federal government—in fact, 27% of the federal budget for basic science is funded by NSF. NSF funding is critical for stimulating new ideas and tools to study the human brain, the most “complex biological structure on Earth”¹, in both normal and diseased patients.

As the Subcommittee continues its work for FY20, we ask that Congress ensure that final FY20 funding is approved before the end of FY19. Reliance on Continuing Resolutions (CR) in place of regular appropriations has immediate and critical implications for scientists working in the neuroscience field. We are currently experiencing severe restrictions in the ability of NSF to fund the work of many basic young scientists of extraordinary potential. Even worse are government shutdowns, which pause all science being performed at affected agencies. The 35-day shutdown that occurred earlier this year caused a great deal of damage to NSF-funded projects, halting scientific discovery. There is no substitute for robust, sustained, and predictable funding for NSF-supported research.

The Committee’s support for NSF’s “Understanding the Brain” (UtB) initiative, which is part of the cross-agency BRAIN Initiative, is a critical piece of our nation’s neuroscience effort. Through the UtB initiative, NSF empowers researchers to study principles and processes underlying memories, thoughts, and complex behaviors. Federal investment into the BRAIN Initiative, including NSF funding, will enable the development of new tools and technologies needed to more deeply map brain functions for a plethora of therapeutic applications.

Advances in basic science will ultimately speed discoveries in clinical and translational research. Our discoveries, sometimes unexpected, advance basic knowledge of brain function and reveal new therapeutic targets to treat brain disorders affecting millions of people around the world. Support for basic neuroscience research, including at NSF, is a critical function of the federal government in advancing the foundation for advancements in public and individual health, education, and workforce development. We are extremely encouraged by the pace of discovery in neuroscience and the promise it offers for future treatments of neurological disorders. Some recent, exciting advancements include the following:

The Impacts of Neuroscience Research

Regulation of neuronal communication

My research seeks to understand how neurons communicate with each other. Brain function is defined by neurons communicating information from cell to cell, and from one brain region to another. Communication between neurons is carried across spaces called synapses by neurotransmitters. The number of neurotransmitters available to transmit these signals is controlled by “gatekeepers,” which ensure appropriate size responses. Many therapeutic drugs used in the clinic act on these molecular gatekeepers to dial up or down the flow of

¹ https://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=128239

communication in the brain. I describe the basic properties of gatekeepers and show how they are generated in specific neurons of the brain and nervous system. My work is basic in nature, but these findings inform the development of new therapeutics for treating major neurological diseases, including chronic pain, migraine, epilepsy, and neuropsychiatric disorders.

Research infrastructure to improve understanding of the brain

Improving our understanding of the brain requires a national research infrastructure, where partnerships can be leveraged towards advances in neuroscience. NSF's Next Generation Networks for Neuroscience (NeuroNex) program facilitates partnerships and develops innovative capabilities, including resources, theoretical frameworks, and computational modeling to advance neuroscience research. NSF support for NeuroNex aids in developing new conceptual tools for understanding how neuronal activity gives rise to behavior. In one of the NeuroNex awarded projects, a team of scientists, including myself and three others, are developing new light-emitting molecules—think of a fire fly—for use in studying and correcting abnormal brain activity. The neurotechnologies arising from NeuroNex National Hubs will provide approaches to record, visualize, and manipulate neuronal activity, facilitating diagnosis and treatment of abnormal brain function. An essential aspect of all NeuroNex awards are activities that support workforce training to ensure that we prepare the next generation of neuroscience researchers to use and improve on technologies for improving our understanding of the brain. NSF, therefore, makes a unique contribution to not only developing new technologies in neuroscience but also combining this with training neuroscientists—both are critical to ensure that scientific ideas are translated into technologies and advanced treatments for neuroscience.

Interdisciplinary approaches to neuroscience

Understanding how the human brain functions requires integrative research teams of the best scientists from a range of disciplines, including mathematics, engineering, and biology. NSF recognizes the power of this level of collaboration to advance research and has funded several interdisciplinary projects in neuroscience and cognitive science. One NSF funded project investigates how networks of neurons work together to perceive the world around us and produce coordinated muscle movements. This requires simultaneous, parallel recording of a massive number of brain regions for prolonged periods of time, followed by utilizing machine learning methods to extract meaningful information. This work, only possible through collaborations of neuroscientists with data scientists and computer scientists, has the potential to benefit individuals who have lost the ability to control their limb movement due to brain injury or disease. The ability to record from many individual regions of the brain is revolutionizing our ability to understand complex brain function, and the use of neural stimulation to correct abnormal brain activity is being refined. NSF is funding collaborations with mathematicians, engineers, and neuroscientists to incorporate smart, closed-loop feedback systems to improve therapeutic brain stimulation only when necessary for patients with limited ability to move their limbs, including Parkinson's disease patients and those suffering from chronic pain. In these exciting times for science, NSF is a critical front-line funder of these and many other cross disciplinary research collaborations.

Summary and Conclusion

NSF funding is critical for the future of biomedical research and for training the next generation of researchers, but it is also a major driver of the United States' economy. While our

nation is the global leader, other countries are also investing increasing amounts into biomedical research. Congress must continue to support basic research in order to fuel scientific discoveries, maintain our preeminence as a leader in the field, and continue to drive the United States economy into the future. Nearly one in five US adults live with mental illness, early childhood stress has lasting impacts through adulthood, and the growth of age-related neurological disorders is still increasing. The only way to change the trajectory of neurological and psychiatric disorders is to increase federal government investment in biomedical research.

For these reasons, the SfN urges the Subcommittee to appropriate no less than \$9 billion to NSF. Just as significantly as providing federal funds, we also implore you to complete your action on the FY20 appropriations bill on time, thus avoiding any need for a Continuing Resolution or any chance of a government shutdown, as we saw earlier this year.

On behalf of the Society for Neuroscience, we thank Congress for its support and look forward to working with you as you undertake your work on the FY20 appropriations process. SfN is here to be a resource for you, now and into the future, in order to ensure that basic research remains central to our economy and is supported by our nation's leaders.