Richard Huganir, PhD, President, Society for Neuroscience

Mr. Chairman and members of the Subcommittee, I am Richard Huganir, President of the Society for Neuroscience (SfN), and it is my honor to present this testimony on behalf of the Society in support of increased funding for the National Science Foundation (NSF) for fiscal year (FY) 2019. As a professor at, and the director of, The Solomon H. Snyder Department of Neuroscience at Johns Hopkins University, I understand the importance of federal funding for neuroscience research. I am offering this testimony in my capacity as President of SfN, an association of nearly 36,000 neuroscientists from all 50 states and around the world. Our members stand with the broader scientific community in requesting $8.45 billion for NSF in FY19, which will continue to build our understanding of the most basic brain functions, allowing for further discovery. We also urge the committee to complete their appropriations work in advance of the September 30 deadline, to provide certainty to scientists that rely on federal funding to support their work.

NSF research significantly impacts scientific discoveries—exhibited by the fact that since 1952, 217 Nobel Prize recipients have received NSF funding. Providing robust funding for NSF allows for the investments needed in basic science to bring about the next breakthroughs in the health, education, and well-being for Americans. Supporting NSF is critical to continue broad scientific advancements, and increasing NSF's budget specifically allows for the development of new tools and technologies to advance neuroscience. As the incidence of brain diseases and disorders continues to grow, our ability to diagnose and treat disease becomes ever more critical. The basic science funded by NSF serve as the foundation for some of our most significant scientific advances. Advancements in our understanding of the brain and nervous system rely on continued discoveries and development of the tools that will allow us to observe the most "complex biological structure on Earth,"[1] the brain, in new ways. These endeavors rely on support from the federal government—in fact, 27% of the federal budget for basic science is funded by NSF.

As the Subcommittee continues its work for FY19, we also ask that Congress work to ensure that final FY19 funding is approved before the end of FY18. Reliance on continuing resolutions in place of regular appropriations has real implications for scientists working in the field, as it severely restricts NSF's ability to fund science. For some, this means waiting for a final decision on NSF's funding before knowing if their highly scored grant will be supported. This delays the launch of research, hiring of researchers, and otherwise causes meritorious science to sit on the shelf. For others, it means operating a lab at reduced funding levels until full-year appropriations are finalized—similarly impacting hiring and causing science to "stop and start"—resulting in wasted effort, data, and resources. There is no substitute for robust, sustained, and predictable funding for NSF.

We are also appreciative of the Committee's support for NSF's Understanding the Brain program, including the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. This multi-agency, targeted portion of the overall federal investment in neuroscience, which includes NSF, will help develop the tools needed to look deeper into the brain to map functions for a plethora of applications.

The deeper our grasp of basic science, the more successful those focused on clinical and translational research will be. Basic research, like that supported by NSF, creates discoveries–sometimes unexpected–that expand our knowledge in unanticipated ways. Basic research in

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

neuroscience is a critical function of the federal government as it builds the foundation for advancements in public and individual health, education, and workforce. Some recent, exciting advancements include the following:

The Impacts of Neuroscience Research

New technologies unlock the brain's mysteries

My own BRAIN Initiative supported research investigates how neurons communicate and coordinate with each other to form circuits. Neurons are constantly relaying information to each other through connections called synapses. Neuroscientists previously discovered that multiple kinds of internal cellular inputs influence the responsiveness of the receiving neuron, strengthening or weakening the connection of particular pathways. This process is essential for learning and memory and is impacted in neurological and psychiatric disorders like Alzheimer's disease, autism, and schizophrenia. Today monitoring more than one pathway at a time is a challenge, and consequently, we have a limited understanding of the complexities of how synaptic changes occur and are regulated.

My laboratory is developing new tools to simultaneously evaluate multiple types of cell signaling to better understand brain activity during learning in awake, behaving animals. These tools will enable us to develop a complex, and more complete, picture of how learning and other higher brain functions are achieved. Ultimately, the tools developed in my laboratory may inform how specific cell circuits involved in learning are affected by neurological diseases and disorders. My hope is that the tools generated will help other neuroscientists overcome some of the enormous challenges they face when studying the brain.

Improving noninvasive diagnostics

NSF supported research is also providing necessary foundations for additional transformative findings beyond the BRAIN Initiative. Over the last 25 years, optical coherence tomography (OCT) imaging has revolutionized ophthalmology by creating 3D images of the human eye at micrometer resolution. OCT is an effective diagnostic tool, capable of imaging a wide spectrum of conditions, from blood vessel blockages to early stage tumors, without harming surrounding tissue. Multiple fields of medicine, beyond ophthalmology, including cardiology, oncology, and dermatology, are now starting to use OCT given the sensitivity of the imaging. Numerous OCT applications were discovered through NSF funded research, and NSF continues to support improvements in the amount of tissue imaged, speed, and affordability of OCT. For example, an NSF funded project developed a photonic chip that both increases the speed of OCT and shrinks the device to the size of a U.S. quarter. A functional result in improving the speed of OCT imaging has the potential to multiply its clinical applications. For instance, improving the speed of OCT imaging allows clinicians to detect blood flow changes in even the smallest blood vessels.

Basic Neuroscience Research: A Key Investment for the Nation

Neuroscience, and basic research, is a critical federal investment with implications for not only health and well-being, but also for education, national security, and the economy. In 2017, nearly 353,000 Americans directly benefited from NSF programs through salaries, stipends, or participant support with millions of others impacted through educational and research related activities.[2] In 2011 alone, over 670 spin-off companies were formed from university research

[2] https://www.nsf.gov/news/news_summ.jsp?cntn_id=100595

efforts.[3] In fact, one dollar of research money from NSF results in two dollars in economic output.[4]

Equally as critical to the future of U.S. scientific leadership, NSF trains the next generation of America's scientists and science educators through tools like the graduate research fellowships—over 50,000 since 1952.[5] This training provides a foundation for a strong economy built on scientific advances and the pioneers driving innovation, spurring the development of new businesses and jobs. With a basic understanding of the environments we live in, we can transform the way we treat disease, learn, work, and engage with the world.

Thank you for the opportunity to testify today. SfN respectfully requests that the Committee provide $8.45 billion to NSF so researchers can continue their important work. Additionally, we ask Congress to complete funding decisions on time, which will allow for the use of resources to be optimized.

[3] Sparking Economic Growth 2.0. The Science Coalition. October 2013.

[4] Gundaya, D. and Inazu, J.K. The Economic Impact of Federal Funds on a Local Community in Hawaii. June 2011.

[5] https://www.nsf.gov/pubs/2017/nsf17003/nsf17003.pdf