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 strong support of at least $39.3 billion in funding for the National Institutes of Health, a $2.215 billion increase over FY18 enacted figures. 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. In my laboratory, we use federal funding from NIH, including funding from Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, to expand our knowledge about how our brain adapts and transmits information. Specifically, we are building tools to help other researchers look more deeply into the brain to determine what functions are involved in learning and memory. While this research will not result in a cure tomorrow, it has the capacity to help laboratories around the globe gain a better understanding of how the brain works and provide a foundation to launch research projects that were not possible before. Funding for NIH is critical to understand the brain and nervous system.

Thanks to the efforts of this Subcommittee, NIH has experienced significant funding increases in recent years. 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 NIH's ability to fund science. For some, this means waiting for a final decision on NIH's funding before knowing if their highly scored grant would 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 90 percent of the awarded funding 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 NIH.

As a BRAIN funded scientist, I would also like to express the Society's appreciation for your support of the BRAIN Initiative. The BRAIN Initiative is a critical piece for promoting future discoveries across neuroscience and related scientific disciplines (see an example below). By including part of this funding in 21st Century Cures – and note that it is only part of the funding that the BRAIN Initiative will require – Congress is maintaining the momentum of this endeavor. Please remember however, using those funds to supplant regular appropriations would be counterproductive and not fulfill the intent of 21st Century Cures.

The deeper our grasp of basic science, the more successful those focused on clinical and translational research will be. Neuroscientists use a wide-range of experimental and animal models that are not used elsewhere in the research pipeline. Basic research creates discoveries–sometimes unexpected–that expand our knowledge of biological processes. These discoveries reveal new targets to treat brain disorders that affect millions of people in the United States and beyond. 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. And yet today, monitoring more than one pathway at a time is a challenge. 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. The tools developed in my laboratory will also inform how specific cell circuits involved in learning are affected in disorders mentioned above. My hope is that the tools generated will help other neuroscientists overcome some of the enormous challenges they face when studying the brain.

Cutting-edge research on addiction

NIH supported research is also addressing the nation's addiction crisis by determining how drug abuse affects the brain. Critically, more than half of new drug users are teens. A teenage brain is different than an adult's brain in many ways – it is both more malleable and vulnerable to insult. Unprecedented in scale, the NIH Adolescent Brain Cognitive Development (ABCD) study is tracking brain development and substance use of over 10,000 U.S. children from childhood through adulthood. The ABCD Research Consortium includes a data analysis center and 21 research sites across the country to conduct assessments in preadolescents prior to risk-taking experiences like drug experimentation. This data was recently released and provides researchers with a high-quality baseline to evaluate the effects of teen drug exposure. Researchers will follow teens involved in the study for ten years and repeatedly evaluate brain structure, function, and behavior to uncover critical risk factors and the developmental

consequences of drug misuse. The results will represent teens from all demographics and inform strategies to prevent drug use and addiction and guide future precision medicine-based treatments.

NIH is also assisting and supporting strategic efforts to combat opioid addiction. NIH-funded researchers are developing next generation pain relievers that target pain without eliciting euphoria, a key side effect that contributes to addiction. Most current opioid medications bind to several receptors and their interactions trigger pain relief alongside a range of negative side effects. An example of this work is a project funded by the National Institute on Drug Abuse, which revealed the structure of a receptor in the brain, providing researchers with a critical foundation for designing future non-addictive pain medications. By understanding this receptor, researchers can develop medications that selectively target specific actions in the hope that these drugs will treat pain without leading to addiction or risk of overdose, and be the precise, safe alternative to opioids that our country so desperately needs.

The Impact of Neuroscience Investment

While the research funded at the NIH is important to the future of health, it is also a key economic driver. Most of the funding provided to the NIH is dispersed to universities and research organizations across the country resulting in significant contributions to local economies. In FY16, when Congress provided the first of its $2 billion increases for NIH, 27,000 new jobs were created combined with an additional $4 billion in economic activity. In 2016 alone, NIH funding spurred almost $64.8 billion in economic activity nationwide.[1]

Congress's commitment to fund basic and translational neuroscience creates the essential foundation to address diseases that strike nearly one billion people globally and more than 100

[1] http://www.unitedformedicalresearch.com/wp-content/uploads/2017/03/NIH-Role-in-the-Economy-FY2016.pdf

million Americans every year. Perhaps the most frightening number to consider, however, is $800 billion. This is the current estimate of the economic impact on American families and the economy of diseases and disorders of the brain.[2,3] This number will only grow in the years ahead, into the trillions, unless we act.

For the United States to remain a scientific leader, Congress must continue its commitment to funding basic research. If we delay or decrease funding for research, other nations in Asia and Europe, who are investing heavily, will catch up–and pass–us in the near future. Meanwhile, we have seen a divestment from industry in neuroscience and philanthropic support cannot fill the void. It is too expensive for charities; it is too far from the profit centers for private industry. Only Congress can take the steps necessary to ensure all Americans will see progress in the development of cures, treatments, and methods of prevention that will assure a better, healthier future.

On behalf of the Society for Neuroscience, we thank this Subcommittee for its support and we look forward to working with you in the months and years ahead.

[2] Brain Facts: A Primer on the Brain and Nervous System. Society for Neuroscience. 2012.
[3] Gooch, C., Pracht, E., Borenstein, A. 2017. *The burden of neurological disease in the United States: A summary report and call to action.* Annals of Neurology, 81(4):479-484.