

Written Statement  
Gina Turrigiano, PhD, President, Society for Neuroscience  
Subcommittee on Commerce, Justice, Science and Related Agencies  
Appropriations Committee  
In Support of FY23 Appropriations for the National Science Foundation

Chair Cartwright, Ranking Member Aderholt, and members of the Subcommittee, on behalf of the Society for Neuroscience (SfN), we are honored to present this testimony in support of robust appropriations for biomedical research at the National Science Foundation (NSF). SfN urges you to provide at least \$11 billion, an increase of approximately \$2.162 billion, in funding for NSF in FY23. As both a researcher and a Professor in the Department of Biology at Brandeis University, I understand the critical importance of federal funding for neuroscience research in the United States. My own research identified the ability of brain circuits to “tune themselves” to maintain the appropriate level of excitability, which is critical for healthy brain function.

My research group, supported by NSF funding, made fundamental discoveries in how neurons self-adjust their excitability, making it easier or harder to send electrical messages to other neurons. Over the past two decades, we have unearthed a family of mechanisms that allow for this unique flexibility called “homeostatic plasticity”, so neurons can change the rate they send messages and protect communication in the face of outside disturbances. Our work has many wide-reaching implications: We are studying how learning and memory suffer when these mechanisms malfunction; We are exploring how being awake or asleep affects these mechanisms; and we are investigating how states of being too excitable or not excitable enough contribute to disorders like epilepsy and autism spectrum disorder. Basic research, like my own, is paramount to understanding the brain at a level deep enough to develop treatments and interventions for diseases and disorders.

SfN believes strongly in the research continuum: basic science leads to clinical innovations, which lead to translational uses positively impacting the public’s health. Basic science is the foundation upon which all health advances are built. To cure diseases, we need to understand them through fundamental discovery-based research. However, basic research depends on reliable, sustained funding from the federal government. SfN is grateful to Congress for its support of the important mission of the NSF, which includes a focus on promoting the progress of science and advancing the national health, prosperity, and welfare, through increased appropriations in recent years.

**The Importance of the Research Continuum**

NSF funding for basic research is critical for facilitating groundbreaking discoveries and for training researchers at the bench. For the United States to remain a leader in biomedical research, Congress must continue to support basic research fueling discoveries as well as the economy. 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 not used elsewhere in the research pipeline. These opportunities create discoveries – sometimes

unexpected discoveries –expanding knowledge of biological processes, often at the molecular level. This level of discovery reveals new targets for research to treat all kinds of brain disorders that affect millions of people in the United States and beyond.

NSF basic research funding is also a key economic driver of science at universities and research organizations across the country. Federal investments in scientific research fuel the nation's pharmaceutical, biotechnology and medical device industries. The private sector utilizes basic scientific discoveries funded through NSF to improve health and foster a sustainable trajectory for American's Research and Development (R&D) enterprise. Basic science generates the knowledge needed to uncover the mysteries behind human diseases, which leads to private sector development of new treatments and therapeutics. This important first step is not ordinarily funded by industry given the long-term path of basic science and the pressures for shorter-term return on investments by industry. Congressional investment in basic science is irreplaceable in the pipeline for development of drugs, devices, and other treatments for brain-related diseases and disorders.

Another example of NSF's success in funding neuroscience is the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative. A part of the research landscape in neuroscience, the BRAIN Initiative has been critical in promoting future discoveries across neuroscience and related scientific disciplines. By including funding in the 21<sup>st</sup> Century Cures Act, Congress helped maintain the momentum of this endeavor. Note, however, using those funds to supplant regular appropriations would be counterproductive. There is no substitute for robust, sustained, and predictable funding for NSF. SfN appreciates Congress' ongoing investment in the BRAIN Initiative and urges its full funding in FY22. Some recent exciting advancements in NSF funded neuroscience research include the following:

#### **N95 mask smart monitoring devices**

As SARS-CoV-2 is a respiratory virus, face masks have emerged as a protective mechanism. N95 masks are recommended by medical professionals. At Northwestern University, researchers have taken the N95 mask and engineered a smart monitoring device, calling it a "Fitbit for the face". The device is a small sensor that attaches to the inside of an N95 mask and can detect heart rate, respiration rate, and the mask wear time. These are all collected on a smart phone app, and the app can also alert users when there are mask leaks. The device's portability and ability to harvest energy from the heat and motion of mask wearers increases the sensors battery life of up to 11 days or more. Researchers hope this device will help medical professionals better detect Covid-19.

#### **Opioid epidemic may be countered by respiration-detecting technology**

There is an opioid epidemic in the United States. In 2019, the National Institute on Drug Abuse reported nearly 50,000 people in the United States died from opioid overdoses. The opioid crisis has only worsened over the course of the Covid-19 pandemic. However, scientists at the University of Washington have created a wearable device that can reverse an opioid overdose. When people overdose on opioids, this causes respiratory failure. The new device works by detecting respiration patterns and motions in its user during an opioid overdose. If the user stops breathing or moving, the device administers naloxone, a competitive antagonist that works to

restore respiration. The researchers at the University of Washington have tested this device in both a supervised injection facility and a hospital. They found their closed-loop system accurately tracked breathing rate in self-injected and simulated opioid-induced apneas. This system has the potential to detect opioid overdoses before becoming fatal and could reduce the burden of the opioid epidemic.

### **Funding in Regular Order**

SfN joins the biomedical research community in supporting an increase in NSF funding to at least \$11 billion, a \$2.162 billion increase over FY22. This proposed increase is necessary to provide certainty to the field of science, allowing for the exploitation of new scientific opportunity, additional training of the next generation of scientists, increased economic growth and further improvements in the public's health. Equally as important as providing a reliable increase in funding for biomedical research is ensuring funding is approved before the end of the fiscal year. Continuing Resolutions have significant consequences on research, including restricting NSF's ability to fund grants. For some of our members, this means waiting for a final decision to be made on funding before knowing if their perfectly scored grant would in fact be realized or operating a lab with 90 percent of the awarded funding until appropriations are final. This negatively impacts all the positive benefits research provides the field. SfN strongly supports the appropriation of NSF funding in a timely manner which avoids delays in approving new research grants or causes reductions in funding for already approved research funding.

SfN thanks the subcommittee for your strong and continued support of biomedical research and looks forward to working with you to ensure the United States remains the global leader in neuroscience research and discovery. Collaboration among Congress, the NSF, and the scientific research community has created great benefits for not only the United States but also people around the globe suffering from brain-related diseases and disorders. On behalf of the Society for Neuroscience, we urge you to continue this critical cooperation and support of biomedical research.