Public Witness Testimony
John H. Morrison, Ph.D., Society for Neuroscience
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Subcommittee on Domestic Policy

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to testify, and for the committee's interest in neuroscience research and development. I am John H. Morrison, PhD, the Dean of Basic Sciences and the Graduate School of Biological Sciences at Mount Sinai School of Medicine in New York City. I am here today on behalf of the Society for Neuroscience (SfN), where I am currently Chair of the Public Education and Communication Committee, and an incoming member of the Society's Council, its board of directors.

It is an honor to be here to discuss the potential and promise of brain research and to update the subcommittee on emerging discoveries and opportunities for greater collaboration. I will also discuss briefly why the nation, and the world, must make aggressive investment in brain research a top priority in coming years given looming health and economic trajectories that are potentially devastating.

About SfN

The Society for Neuroscience is a nonprofit membership organization of more than 40,000 basic scientists and clinicians in more than 80 countries who study the brain and central nervous system. Our members work across the entire research spectrum to advance basic understanding of brain function and how it goes awry, and are engaged in a broad range of scientific research endeavors aimed at understanding, treating and preventing disorders of the brain and nervous system. They also facilitate the translation of basic science discoveries into treatment strategies for more than a thousand illnesses ranging from Alzheimer's to autism and attention deficit disorder; from multiple sclerosis to mental illness; from vision and hearing loss to paralysis or limb loss; and from post traumatic stress disorder (PTSD) to traumatic brain injury (TBI). Our researchers are also deeply engaged in understanding the roots of healthy human development, healthy aging, stress, obesity, and other conditions that affect or promote brain wellness. Neuroscience is a broad and deeply interdisciplinary field, relying on crucial advances in physics, computer science, mathematics, chemistry, engineering, and basic biology to develop new tools and techniques for studying brain cell activity and behavior.

In pursuit of its mission, SfN provides the world's largest venues for emerging brain science discovery, including hosting one of the world's largest annual scientific meetings, with more than 30,000 attendees, and publishing the broadest and most comprehensive neuroscience journal in the field with more than 15,000 pages of groundbreaking science per year. SfN also provides professional development activities and resources for neuroscientists at all career stages; promotes public information and education; and informs policymakers about knowledge resulting from neuroscience research and implications for public policy and continued scientific progress.

Founded in 1969, the Society's rapid growth today reflects the progress, promise, dynamism, and growing interest in the field. Today, the fastest growth has been among students and international

members, and these are vital and encouraging trends as they represent a strong pipeline of young talented scientists and strong partnerships for continued scientific collaboration.

The Achievements and Future Promise of Neuroscience

America's neuroscience research enterprise has already demonstrated it is a proven pathway to improved health for millions of Americans, better scientific knowledge for human kind, and a stronger economy in hundreds of communities. While we have much farther to go, neuroscientists have made tremendous progress in the understanding and treatment of diseases and disorders. Among other progress, we have emerging genetic or bioengineered treatments for vision and hearing loss; deep brain stimulation for Parkinson's and its promise for other disorders; new understanding of the brain circuitry involved in major mental illness; knowledge of how memories are formed and lost; as well as progress on the genetic contribution to many disorders, as well as emerging biomarkers for many of them as well.

Based on these advances, the neuroscience community today is on the cusp of making transformational progress thanks to new tools and technologies that enable us to study brain function at the cellular, molecular and genetic levels as well as in the living brain as never before. Aggressive and sustained investment in neuroscience is among the most pivotally important components of progress for the 21st century, and it will ensure that we capitalize on the investments and discoveries over past decades.

Today, I offer just two examples of emerging discoveries that hold promise for research and the American people:

Post Traumatic Stress Disorder (PTSD)

A recent study conducted by the RAND Corporation found that an estimated 20 percent of returning service members who served in Iraq and Afghanistan report symptoms of PTSD or major depression. Basic scientific research taking place over the last two decades has significantly contributed to our understanding of PTSD as a serious brain disorder with biological underpinnings. Neuroscientists are making great strides in understanding the brain circuits involved in this complex disorder and how these circuits are altered by stress. For example we now know of a number of altered brain chemicals and systems associated with PTSD including the presence of higher levels of norepinephrine in the brains of PTSD patients; and the part of the brain that links learning and memory to emotion appears to be smaller in people with PTSD. As a new generation of U.S. service members return home from the wars in Iraq and Afghanistan after prolonged exposure to combat-related stress and trauma, the importance of linking basic scientific research findings to clinical innovation is critical to service members, their families, and their caregivers.

The Aging Process

Neuroscientists are also making tremendous progress in better understanding the neurological components of the aging process. We now know that a part of brain cells called spines are depleted as we age, resulting in declines in cognition in the parts of the brain associated with higher levels of learning. These spines are linked to an important class of synapses involved in learning, and many of the synaptic molecules required for this

process have been identified. These basic research findings provide scientists and clinicians with new therapeutic targets to help prevent the loss of function, now that we have identified which spines are lost as we age and their impact on cognition. Neuroscientists have also discovered that the biological events that lead to age-related cognitive impairment are not inevitable. These findings will allow for the development of prevention strategies, while also establishing a foundation for therapeutic tools to reduce cognitive decline through pharmaceutical and lifestyle interventions. Such progress on cognitive aging will surely impact the greatest of all burdens associated with aging and Alzheimer's disease.

These promising discoveries are made in part because, as you heard on today's first panel, neuroscience has a strong partner in the United States federal government. Indeed, we are deeply grateful and proud that America has helped propel the progress of this field through funding at the National Institutes of Health, the National Science Foundation, Department of Defense, Department of Veterans Affairs, and many other institutions that have fueled tremendous progress in diagnosing and treating neurological disorders.

The Importance of Neuroscience Research

Health and disease

In the United States, the more than 1,000 disorders of the brain and nervous system result in more hospitalizations than any other disease group, including heart disease and cancer. Neurological illnesses affect more than 50 million Americans annually, at costs exceeding $460 billion. In addition, mental disorders, excluding drug and alcohol problems, strike 44 million adults a year at a cost of some $148 billion. As has been noted today, neurological and psychiatric conditions will also be hallmark wounds of this era's returning veterans. PTSD, TBI, limb loss, sight and hearing impairment are all major consequences of today's battlefield. The World Health Organization (WHO) reported in 2007 that an estimated 1 billion people suffer worldwide from neurological diseases and disorders, causing 6.8 million deaths annually. Mental health conditions affect millions of people in the world, with WHO estimates of 151 million people suffering from depression, 26 million from schizophrenia, and 125 million from alcohol use disorders. And because many brain diseases affect individuals in their prime earning years, and not just the elderly, the cumulative impact of brain diseases on economic productivity is very significant.

Economic Impact

Finally, In addition to increasing knowledge and identifying new promising health outcomes, a strong investment in basic scientific innovation is also critical to our national economy. First, it is helping to generate economic activity nationally and at the local level, creating thousands of high-wage, high-tech jobs and sectors at a critical time for our economy and the U.S. biomedical research industry. Second, a continued focus in basic science will help ensure that the U.S. remains the world leader in biomedical research. Even as SfN collaborates with global partners, we recognize that strong U.S. leadership is crucial to helping to advance groundbreaking research around the globe while protecting our nation's future. The neuroscience community feeds our nation's larger innovation and R&D pipeline, making our nation the most highly regarded engine of innovation in the world. However, there is growing global competition to lead

this innovation race, and while competition enhances outcomes, we all agree that a strong and vibrant US science and technology sector is vital to the country and the globe.

Finally, from an economic perspective, biomedical research must also be seen as one primary solution for diseases and disorders that already cost societies hundreds of billions of dollars a year, several of which increasingly threaten our social fabrics. One need not look any further than my area of expertise, Alzheimer's disease, to see this fact in stark relief. Two years ago, the Alzheimer's Study Group, co-chaired by former Speaker Newt Gingrich and former Senator Bob Kerrey and comprised of bipartisan policy and science leaders, painted a stark and troubling picture of the social impact of Alzheimer's disease if more progress is not made to delay or even prevent progression of the disease. It reported that Alzheimer's disease afflicts more than 5 million Americans and is already the nation's third most expensive disease, not even counting more than 94 billion hours consumed annually in uncompensated caregiver assistance. Unchecked, Alzheimer's cases will increase by more than 50 percent in 20 years and double again to as many as 16 million cases by 2050. This will result in disease-related costs to Medicare and Medicaid alone of $20 trillion in constant dollars over 40 years, rising to over $1 trillion per year by 2050.

The outlook for Alzheimer's is not morally sustainable for those millions who we know will suffer terribly, or for their families. It is also not economically sustainable for our nation or other aging nations around the world. And this situation is repeated for more than 1,000 other brain based disorders as populations grow and age. At a time of economic challenge for our nation, the economic question is not "how can we afford to invest in research." Rather, it is "how can we afford ***NOT*** to invest in research that has the potential to save many times the dollars invested."

The Neuroscience Challenge: Science and its Service for Health

In my view, the basic science findings discussed today, and their vital clinical and societal impact, remind us that scientists and medical practitioners must be much more engaged in two-way dialogue if we are to ensure discoveries translate into treatments and that clinical observations are integrated into research development. Additionally, neuroscientists know more than ever about the interaction and interconnections between brain anatomy, functions, and disorders. Thus, neuroscience research that benefits one condition or disorder in fact has broad potential applicability for many conditions. In my view, these truths make it critical to help the broad brain science community break down silos, and encourage more collaboration that crosses traditional scientific boundaries, areas of expertise, and advocacy priorities.

One of the most critical collaborations is across what has traditionally been thought of as two largely independent enterprises, basic science and clinical research. In fact, we must recognize that both endeavors are necessary components of a continuum that leads to translation. In my view, we must approach the future of neuroscience with a focus on "translational basic science." We must encourage and facilitate scientists and clinicians to work as a team to translate scientific knowledge and discoveries into specific personalized approaches to diagnosis, treatment and prevention of disease. As we move forward, our mission must be to seamlessly integrate clinical relevance into scientific research while ensuring that the system continues to encourage those

foundational research advances for which future applications have not yet, but surely will, be discovered.

There is no better example of the importance of practical scientific application and translation than our increased understanding of synaptic brain plasticity, which is, in essence, the brain's ability to modify neural connections to better cope with new circumstances. This capacity for change and adaptation is a fundamental property of the synapse. The synapse is the place where neurons "talk" to one another using electrical and chemical signals, which in turn produces brain function and behavior. The foundational understanding of synaptic plasticity emerged from basic science. Yet today, our knowledge that the brain can adapt to injury or disease and help rewire itself is having a revolutionary impact on our understanding of learning and memory, and many other topics of deep important clinical relevance. Harnessing synaptic plasticity through innovative therapeutics will be critically important for treatment of chronic pain, psychiatric disorders such as PTSD and depression, and neurological disorders like TBI, stroke, and epilepsy.

Conclusion

In closing, I stress that today we live on the forefront of an era of breathtaking potential to advance biological knowledge and human health. And we are all fortunate to have NIH, NSF, DoD, VA, and many other strong public and private neuroscience research entities contributing to the world's finest research enterprise and a strong economic engine for America. As the nation considers difficult decisions in the face of economic strain, prioritizing strong funding and encouraging collaboration across the neuroscience spectrum remains a critical and wise investment precisely because it contributes so much to our health and economic strength.

The tremendous investments we have made in basic scientific study are paying off and should be strengthened. The field of neuroscience holds unbounded potential for addressing the broad range of neurological and psychiatric illnesses that impact millions of Americans annually and more than a billion throughout the world. Our future success will depend in large measure on sustaining the strong investment in basic discovery as well as team-oriented collaborative approaches between the basic researcher charting a path for new discoveries and knowledge and the clinical-physician researcher translating those discoveries into new and better treatments and cures. Mr. Chairman, Ranking Member Jordan, and members of the subcommittee, I look forward to the road ahead in this exciting field and what our success stories will mean for the American people.

Thank you again for the opportunity to testify. I look forward to answering any questions that you might have.