

Written Statement
Michael E. Goldberg, President
Society for Neuroscience
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Introduction

Mr. Chairman and Members of the Subcommittee, I am Michael E. Goldberg, M.D. I am the David Mahoney Professor of Brain and Behavior, in the Departments of Neuroscience, Neurology, Psychiatry, and Ophthalmology; as well as the Director of the Mahoney-Keck Center for Brain and Behavior Research at Columbia University and President of the Society for Neuroscience (SfN). My area of specialization is the physiology of cognitive processes: visual attention, spatial perception, and decision making.

On behalf of the 40,000 members of the Society for Neuroscience, I would like to thank you for your past support of neuroscience research at the National Institutes of Health (NIH). Research funded by NIH has returned significant dividends in terms of improved patient care as well as the development of prevention programs for brain and nervous system disorders. In this testimony, I will highlight how taxpayers have benefited from this investment, and how a sustained investment can enhance medical research, health, and economic strength.

Fiscal Year 2011 Budget Request

The entire scientific community is deeply grateful for the historic investment in NIH through the American Recovery and Reinvestment Act (ARRA), which is now funding high quality research, while creating and preserving jobs. This investment in innovation and science is not only setting a path to new discoveries, but also helping to stimulate the national and local economies, preserving or creating an estimated 50,000 new high-wage, hi-tech jobs at a critical time for U.S. research, and producing an estimated 2.5 return on investment for local communities. **To continue this exciting scientific and economic momentum and maintain the current research capacity, the Society respectfully requests that Congress provide a fiscal year 2011 appropriation in the amount of \$35 billion for NIH.** This level of funding will build on the research activities supported by the regular 2010 appropriations and ensure that the nation's universities do not lose scientific ground, and be forced to lay off thousands of U.S. scientists and their support staffs, when the ARRA funding ends this year. A strong investment in the scientific enterprise will ensure that there is not a dramatic drop in research activity and more job losses, as well as serve strong encouragement to keep our young researchers in the training pipeline and keep the programmers, technicians, and engineers so critical to biomedical research in their jobs.

What is the Society for Neuroscience?

The Society for Neuroscience (SfN) is a nonprofit membership organization of basic scientists and physicians who study the brain and nervous system. SfN's mission is to:

1. Advance the understanding of the brain and the nervous system.
2. Provide professional development activities, information, and educational resources for neuroscientists at all stages of their careers.

3. Promote public information and general education about the nature of scientific discovery and the results and implications of the latest neuroscience research.
4. Inform legislators and other policymakers about new scientific knowledge and recent developments in neuroscience research and their implications for public policy, societal benefit, and continued scientific progress.

What is Neuroscience?

Neuroscience is the study of the nervous system—including the brain, the spinal cord, and networks of sensory nerve cells, or neurons, throughout the body. Humans contain roughly 100 billion neurons, the functional units of the nervous system. Neurons communicate with each other by sending electrical signals long distances and then releasing chemicals called neurotransmitters which cross synapses—small gaps between neurons.

The nervous system consists of two main parts. The central nervous system is made up of the brain and spinal cord. The peripheral nervous system includes the nerves that serve the neck, arms, trunk, legs, skeletal muscles, and internal organs.

Critical components of the nervous system are molecules, neurons, and the processes within and between cells. These are organized into large neural networks and systems controlling functions such as vision, hearing, learning, breathing, and, ultimately, all of human behavior.

Through their research, neuroscientists work to:

- Describe the human brain and how it functions normally.
- Determine how the nervous system develops, matures, and maintains itself through life.
- Find ways to prevent or cure many devastating neurological and psychiatric disorders.

NIH-Funded Brain Research Successes

The funds provided in the past have helped neuroscientists make significant progress in diagnosing and treating neurological disorders. Today, thanks to NIH-funded research, scientists and health care providers have a much better understanding of how the brain functions.

The following are a few of the many success stories in neuroscience research:

- **Post-Traumatic Stress Disorder (PTSD)** – For years it was thought that those who survived or witnessed a trauma should be able to tough it out and move on. But scientific studies funded by the NIH helped reveal that PTSD is a serious brain disorder with biological underpinnings. Health care practitioners today are better able than ever to help those who have suffered a traumatic event to cope, thanks to research over the past 20 years. Yet much remains to be done, and this research must continue aggressively in light of returning veterans' health care needs in coming generations. NIH-funded studies on the brain chemicals and structures altered in PTSD offer particular hope for developing effective treatments. One approach is to target the corticotrophin-releasing factor (CRF), a brain chemical that plays a crucial role in coordinating the body's response to stress. And NIH-funded studies showed that drugs called selective serotonin reuptake inhibitors improved the memory of patients with PTSD and reduced shrinkage of brain tissue in the part of the brain involved in memory and emotion, helping PTSD patients

better deal with traumatic memories.

- **Age-Related Macular Degeneration** – As you grow older, you may some day notice your vision becoming blurry or distorted. Straight lines appear wavy, and it becomes more difficult to recognize familiar faces. These signs may point to age-related macular degeneration, or AMD, the leading cause of blindness and vision impairment among older Americans. AMD is a form of neurodegeneration that affects the light-sensitive nerve cells in the retina at the back of the eye. AMD causes nerve cells in the macula, the central region of the retina, to break down, and abnormal deposits accumulate beneath the retina. Many elderly people with AMD become socially isolated from friends and family and can no longer participate in the activities they once enjoyed. Thanks to work supported by NIH, scientists have made rapid advances in understanding AMD and are beginning to develop new treatments. Getting older remains the strongest risk factor, but scientists now know that AMD results from a complex interaction among genetic and environmental factors. For example, smoking increases the risk. One recent NIH study found that supplementing the diet with high levels of antioxidants and zinc reduced patients' risk of developing the advanced form of AMD disease by about 25 percent. The first drug to treat AMD was approved by the FDA in 2000. When this drug is activated by the application of laser light, it eliminates the faulty blood vessels underneath the retina and reduces further loss of vision. Doctors also may treat the disease directly with laser surgery, destroying new blood vessels and sealing leaks. Scientists have found important similarities between deposits that form in the eye in AMD and deposits in the brain in age-related neurodegenerative diseases such as Alzheimer's and Parkinson's. The deposits are found in some types of kidney disease as well. Because the effects of treatments are easier to visualize in the eye, studies of AMD may lead to improved treatment of these other diseases.
- **New Treatments From Nature's Poisons** – Neuroscientists have uncovered an unlikely source of new treatments for neurological disorders and diseases—the toxins and venoms of fish, snails, frogs, scorpions, and other creatures of land and sea. Brain researchers are finding that what makes these poisonous substances dangerous in the wild may also make them useful tools in the clinic. Already, they are helping to relieve chronic pain, and they may one day prove effective in treating brain cancer. One deadly venom—that of the giant yellow Israeli scorpion aptly nicknamed the “deathstalker”—is being studied as a possible tool in the treatment of glioma, the most common type of brain tumor. Each year, about 22,000 Americans are diagnosed with this quickly spreading cancer, and many die within 12 months. Glioma cells spread throughout the brain, including into its narrowest spaces, with the help of special ion channels not found in healthy brain cells. A chemical in the deathstalker's venom, chlorotoxin, binds to these ion channels, an action that slows down the cancer's growth without harming nearby healthy cells. Other research suggests that chlorotoxin may be able to help kill gliomas and perhaps other cancerous tumors through a different mechanism—by shutting off their blood supply. A non-narcotic synthetic form of a poisonous compound found in the venom of cone snails is already helping to relieve chronic neuropathic pain in humans. Neuroscientists are currently investigating whether other chemicals in cone snail venom might help block the surge of electrical brain activity that triggers epileptic seizures.

The above success stories required a close working collaboration between the basic researcher discovering new knowledge and the clinical-physician researcher translating those discoveries into new and better treatments. Much other research in neuroscience is dedicated to understanding basic phenomena, which, although motivated by clinical problems, are not yet at the stage where they can

be translated into cures. For example, patients with lesions in the parietal lobe, a part of the cerebral cortex, are devastated by deficits in visual attention and spatial perception. NIH-supported research in my own laboratory has illuminated much of the signal processing by which the parietal lobe enables subjects to locate objects in space and attend to them. We now understand why patients with parietal lesions behave as they do; helping them is the next step. Other groups in the Mahoney-Keck Center at Columbia University are doing NIH-supported research into the basic mechanisms of how subjects assign value to objects in the world, and make choices based on that value. A clinically relevant example of these processes is the question of why a drug addict assigns high value to drugs and then decides to acquire them. This research will illuminate the neurobiology of processes like drug-seeking, and may lead to better treatment,

Conclusion

The field of neuroscience research holds great potential for addressing the numerous neurological illnesses that strike more than 50 million Americans annually. As noted by my institution's (Columbia University) Mind, Brain and Behavior Initiative: "In the 20th century, scientists discovered a great deal about the brain. They discovered what happens to individual neurons when memories are made and created powerful tools to image brain function. But while they made great strides toward understanding molecules, cells, and brain circuitry, scientists continue to unearth how these circuits come together in systems to record memories, illuminate sight and produce language. We have entered an era in which knowledge of nerve cell function has brought us to the threshold of a more profound understanding of behavior and of the mysteries of the human mind. Many believe that the next level of understanding will come from analyses not of single cells but of ensembles of neurons whose concerted actions must underlie the complexity of human behavior and thought. Neural circuits must, in some way, account for high-level functions such as memory, self-awareness, language, joy, depression, and anger. Taking this research to the next level through collaborations with the social sciences will illuminate and identify the role of social interactions in normal and abnormal brain function..." However, this can only be accomplished by a consistent and strong funding source.

An NIH appropriation of \$35 billion for fiscal year 2011 is required to take this research to the next level in order to improve the health of Americans and to sustain the nation's global competitiveness. Additionally, the new research capacity must be sustained to realize the scientific outcomes initiated by the Recovery Act dollars and to ensure the next generations of scientists will have opportunities in research. A strong scientific investment not only produces ground breaking medical treatments and discoveries; it supports national economic recovery, by creating thousands of jobs and forming the foundation for a stronger national economy based on technology and innovation.

Thank you for the opportunity to submit this testimony.

Sincerely,

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