The American Physiological Society Statement on FY 2006 Funding For the National Science Foundation and NASA

The American Physiological Society (APS) thanks you for your ongoing support of the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). Investment in the sciences is critical for ensuring future technological excellence and economic stability in the United States. Both the NSF and NASA support outstanding science programs. Lack of adequate funding for these agencies will slow technology development and will in turn have a negative impact on the economic future of the United States.

The APS is a professional society dedicated to fostering research, education, and the dissemination of scientific knowledge concerning how the organs and systems of the body work. The Society was founded in 1887 and now has more than 11,000 members who teach and do research in colleges, universities, medical and veterinary schools, and other public and private research institutions across the country. The APS recognizes both the enormous financial challenges facing our nation and the enormous opportunities for us to make scientific progress. In this letter the APS offers its recommendations for FY 2006 funding for the NSF and NASA.

NSF

The basic science initiatives funded by the NSF are driven by the most fundamental principles of scientific inquiry, exploring questions that might seem to lack immediate practical application. In fact, the relevance of the knowledge gained will only become apparent over time. The NSF provides support for approximately 20% of federally funded basic science and is the major source of support for non-medical biology research, including integrative, comparative, and evolutionary biology, as well as interdisciplinary biological research. The majority of the funding it provides is awarded through competitive, merit-based peer review, which ensures that the best possible projects are supported. NSF has an excellent track record in terms of funding research endeavors that have produced results with far-reaching potential.

Recently NSF-funded researchers at the University of California, Berkeley made a surprising discovery about how octopuses navigate the varied terrain of the ocean floor. While studying the behavior of octopuses off the coast of Indonesia, these scientists observed one that appeared to be walking on two legs on the ocean floor. “Walking” by an octopus was a behavior that was previously unknown, but subsequent research has documented two other species of octopus able to do so (1). This behavior is thought to be a mechanism to escape predators, but these findings provide insight into how invertebrates can perform a type of movement previously thought to require a vertebrate
musculoskeletal system. You and your constituents could well ask why should federal funds be directed toward research in the octopus, but that research serves as a fine example how such basic science can lead to benefits to humans. The research into octopus navigation is expected to contribute to the development of robotic technologies that can navigate similar terrain more efficiently. Therefore, this basic study could have wide-ranging applications in industry and remote exploration.

Another example of NSF research with far reaching implications involves comparative and evolutionary biology studies on the physiology of the python heart. Physiologists have long known that the heart muscle of athletes changes in response to exercise to allow increased blood flow without increasing the heart rate. However, the molecular mechanisms behind these changes were not clear. Researchers studying the cardiac physiology of pythons observed adaptations in the heart after feeding that are similar to changes that human athletes develop in response to training and conditioning (2). Using the python as a model for the human heart, scientists expect to gain a better understanding of the mechanisms behind cardiac growth in response to exercise.

In addition to such innovative research, NSF also supports outstanding science and math education programs. These programs enhance education at every level from elementary school through graduate school by providing support for both teachers and students. Education programs at the NSF have suffered from recent budget cuts. Although some of the funding for these programs has been shifted to the Department of Education, we believe that the NSF is uniquely qualified to foster excellence in science and math education.

The APS joins FASEB and the Coalition for National Science Funding in recommending the NSF budget be increased to at least $6 billion in FY 2006. The administration recommendation of a $5.61 billion budget for FY 2006 falls short of 2004 funding levels, and poses a particular threat to both the science and science education programs NSF supports.

NASA

The Human Systems Research and Technology (HSR&T) Theme within NASA was created to focus on the health and safety of humans involved in space exploration. During prolonged space flight, the physiological changes that occur due to microgravity, increased exposure to radiation, confined living quarters and alterations in eating and sleeping patterns can lead to health problems and reduced ability to perform tasks. Given NASA’s current focus on manned space exploration, it is critical that resources be devoted to research into the health effects of prolonged space flight. As part of its mission, NASA funds important research efforts that provide insight into the biomedical challenges of manned space exploration. A few examples of outstanding NASA funded science are described below.

One of the most significant risks of prolonged space flight is loss of bone and muscle mass due to inactivity and exposure to microgravity. Upon return to Earth’s atmosphere,
these physiological changes can result in a loss of strength and an increased risk of bone fractures. Researchers studying these phenomena recently showed that adding a dietary supplement of certain amino acids and carbohydrates can stave off the reduction of muscle mass that typically occurs with bed rest, a condition that simulates microgravity \( (3) \). Unfortunately, subsequent work by the same researchers showed that the benefit in terms of muscle mass may worsen the problem of bone loss \( (4) \), which means that further study is needed. Given the prolonged space flights necessary for the manned exploration now being contemplated, it is essential that scientists understand the physiological risks to astronauts and develop ways to diminish them.

Space flight can cause other problems. Returning astronauts may black out briefly when they sit up or stand. The malady is thought to be associated with changes in blood flow to the brain. NASA-supported scientists recently showed that when rats undergo this change of posture, they show pronounced constriction (narrowing) of blood vessels in certain areas of the brain \( (5) \). Understanding how these and other physiological alterations occur may make it possible to provide better medical care for astronauts in space and upon return to Earth. These particular examples of studies into the effects of microgravity are also applicable to patients confined to bed rest, and the results will thus benefit a much wider population.

The APS is concerned that despite the overall funding increase for NASA, the proposed allocation for HSR&T of $806.5 million in the FY 2006 budget request represents a decrease of nearly 20% from the previous year. This reduction is inconsistent with NASA’s increased focus on manned space exploration. The APS joins FASEB in urging increased support for peer-reviewed research into the health risks of long-term space flight and development of appropriate countermeasures.

As highlighted above, investment in the basic sciences is critical to our nation’s technological and economic future. The APS urges you to make every effort to provide these agencies with increased funding for FY 2006.

Studies Referenced