This statement is submitted to the House Appropriations Subcommittee on Science, State, Justice and Commerce, and Related Agencies.

The American Physiological Society
Statement on FY 2007 Funding
For the National Science Foundation and NASA

The American Physiological Society (APS) thanks the Subcommittee for its sustained financial support of scientific research at the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). Scientific research plays an important role in technological innovation and economic development and therefore is vitally important to the future of our nation. The APS applauds the proposed budget increase for NSF, and recommends implementation of the plan to provide the agency with $6.02 billion in Fiscal Year (FY) 2007 and double its budget in the coming years. In contrast, while the proposed overall budget increase for NASA is 3.2%, the Human Systems Research and Technology (HSR&T) theme would be cut by 56%. The APS recommends the restoration of funds to basic life sciences and countermeasures research at NASA to ensure the safety of humans both on the International Space Station and in any future space endeavors.

The APS is a professional society dedicated to fostering research and education as well as 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 do research and teach at public and private research institutions across the country, including colleges, universities, medical and veterinary schools.

The APS recognizes both the enormous financial challenges facing our nation and the significant opportunities for scientific progress. In this testimony, the APS offers its recommendations for FY 2007 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. Although at times NSF-funded research may seem to be exploring questions that lack immediate practical application, we have learned again and again that the relevance of the knowledge gained becomes 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 NSF provides is awarded through competitive, merit-based peer review, which ensures that the best possible projects are supported. NSF has an excellent record of accomplishment in terms of funding research endeavors that have produced results with far-reaching potential.
One example of innovative NSF-funded research that crosses scientific disciplines is the effort by scientists in the Department of Mathematics at Duke University to develop mathematical models of kidney function. The kidney rids the body of waste and regulates fluid volume and balance. By developing mathematically based computer models of kidney function at the cellular level, researchers hope to gain a better understanding of this complex organ and the causes of kidney disease (1). This type of cutting-edge, interdisciplinary research program is essential for the progress of science, which is becoming increasingly interdisciplinary as new technologies emerge.

In another example of NSF-funded research, scientists studying land-dwelling wood frogs at Miami University in Ohio have made some important discoveries about how they survive harsh winter weather. According to their studies, the frogs alter the amount of sugar and other molecules in their bodies in response to cold temperatures, ultimately allowing them to freeze solid in the winter and then thaw again in spring (2). Because frogs share many biological similarities with humans and other mammals, the researchers hope that studying the precise series of physiological events in the frog will allow them to achieve better and longer-term preservation of human organs for transplantation. If human organs could be stored for longer periods, more organs might be available for transplantation and better immunological matches could be achieved. This has the potential to result in longer and healthier lives for transplant patients. In addition, because the frogs undergo cardiac arrest when they freeze, a better understanding of their natural cold tolerance may also shed light on medical problems in humans resulting from hypothermia and oxygen deprivation (3).

In addition to such innovative research, NSF also supports outstanding science and math education programs, which was one of the themes in the President’s State of the Union address. NSF programs enhance education at every level from elementary school through graduate school and therefore should have merited funding increases for FY 2007. Nevertheless, education programs at the NSF have suffered from recent budget cuts, and FY 2007 budget proposal similarly fails to give them the priority they deserve. The President’s budget recommends shifting funding for some NSF educational programs to the Department of Education. We believe that the NSF is uniquely qualified to foster excellence in science and math education and urge that funding for these programs remain at the NSF.

The APS urges Congress to support the important work being carried out at NSF by funding the agency at its requested level of $6.02 billion. In addition, the APS recommends restoration of funding for education programs at NSF.

**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 now to research into the health effects of prolonged space flight. NASA is the only agency whose mission includes addressing the biomedical challenges of manned space exploration. Moreover, this research has already produced findings with potential application to medical problems that occur in other connections. A few examples of outstanding NASA funded science are described below.

A common problem associated with prolonged exposure to reduced gravity is muscle atrophy, including in the muscles of the legs. In an environment with normal gravity, muscle mass is maintained because walking provides both exercise and nerve stimulation in the leg muscles. The kind of muscle atrophy observed in humans following spaceflight can be simulated in laboratory rats, which has permitted researchers opportunities to study ways to counteract its negative effects. Last year several NASA-funded researchers published a study using showing that by artificially stimulating the bottom of the foot using an inflatable boot they could markedly reduce the atrophy that would otherwise occur in the leg muscles (4). If these results can be confirmed in humans, this type of countermeasure may be useful not only in conditions of reduced gravity, but also in patients who are bed-ridden for prolonged periods.

Muscles that have atrophied also show resistance to insulin, a molecule that affects how sugar is absorbed by the body’s tissues. NASA-funded researchers at the University of North Carolina, Chapel Hill, used the same kind of animal model to study insulin resistance in conditions that simulate microgravity. They were able to identify events that occur at the molecular level that lead to insulin resistance, as well as ways the body compensates to allow the muscles to utilize sugar in a way that does not require insulin (5). These studies may have significant implications for keeping astronauts healthy during and after spaceflight. At the same time, they may contribute to our understanding of biological pathways that are important in diabetes, which is a growing health problem in the U.S.

The APS is concerned about the proposed 56% decrease in the allocation for FY 2007, which is inconsistent with NASA’s increased focus on manned space exploration. The APS joins the Federation of American Societies for Experimental Biology (FASEB) in urging both a restoration of the cut and an increase in support for peer-reviewed research into the health risks of long-term space flight and development of appropriate countermeasures.

Investment in the basic sciences is critical to our nation’s technological and economic future. The APS strongly supports federal funding for biological and biomedical research at the NSF and NASA, as it does for funding at the National Institutes of Health, another agency whose budget is in need of Congressional attention to counter the real decline in its ability to fund medical research. The APS urges you to make every effort to provide these agencies with increased funding for FY 2007.