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Chemical Sciences in the FY 2009 Budget

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Chemistry is a central science that seeks to understand the composition and structure of different substances and their properties and reactions. Because an understanding of chemistry is often required for federal agencies to fulfill their missions, support for chemical research is found throughout many government programs. The budget proposal for FY 2009 has been influenced by the President's American Competitiveness Initiative (ACI), which was introduced in February 2006 and calls for a doubling, over 10 years, of investment in "innovation-enabling physical science and engineering research." In the FY 2009 budget proposal:

- support for chemistry would increase at the National Institute of Standards and Technology (NIST) through increased funding of laboratory research and construction programs;

- support for chemistry at the National Science Foundation (NSF) would increase;

- support for chemistry at the Department of Energy (DOE) would see significant increases in Administration priority areas such as hydrogen energy research and nanoscale science;

- support for chemistry at the Department of Defense (DOD) would likely fall with proposed decreased funding in basic and applied research;

- support for chemistry at the National Institutes of Health (NIH) would remain constant; and

- construction continues on the Linac Coherent Light Source and five NanoScale Science Research Centers. These facilities will enable world-class research in emerging chemical fields.

Scientists in academic, government, and industry laboratories perform federally funded chemical research. The results of this research are utilized by government and leveraged by industry to develop various products and services that improve quality of life and help maintain our economic strength. Among a variety of benefits, successes in chemistry have led to effective health and pharmaceutical products, the growth and safety of our nation's food and water supply, the expansion and improvement of our energy sources, new materials for the electronics and information industries, and key technologies for national defense.

The federal government has a particularly important role in the basic chemical sciences performed largely at the university level. It is at this level, and to a large extent with these funds. that the nation's future chemical scientists and engineers are trained. Thus, continued federal investment in the chemical sciences is necessary in order to benefit from future chemical advances.

NATIONAL SCIENCE FOUNDATION (NSF)

Within NSF, the Chemistry Division of the Mathematics and Physical Sciences (MPS) Directorate supports approximately one-half of the Foundation's chemistry research. Support for chemistry research can also be found in other NSF divisions including Materials Research and Physics, Molecular and Cellular Biosciences, Atmospheric Sciences and Earth Sciences, the Computational Research, and Chemical and Transport Systems. The MPS Chemistry Division supports chemical research across a wide spectrum of topics, whereas other NSF divisions support chemistry as it assists in the advancement of divisional objectives. The Chemistry Division provides approximately 38 percent of the federal government's support for academic chemistry research. The Chemistry Division budget would increase 26 percent to $245 million in FY 2009 (see Table II-7) within an MPS budget of $1.4 billion, a $235 million or 20 percent increase. The total NSF FY 2009 budget is $6.9 billion to advance the frontiers of research and education in science and engineering, an increase of $822 million (14 percent).

DEPARTMENT OF DEFENSE (DOD)

DOD supports military-relevant chemical research through the Army, Navy, and Air Force research organizations and through defense-wide research agencies such as the Defense Advanced Research Projects

Agency (DARPA). Basic research funding, referred to as "6.1," is allocated for both intramural and extramural programs.

Chemistry is important in many areas of basic research at DOD. For example, the Air Force Office of Scientific Research (AFOSR) conducts programs in molecular dynamics, theoretical and polymer chemistry, and surface science. These efforts serve the needs of the Air Force for new lightweight materials, better understanding of atmospheric processes, more energetic and efficient propellants, improved corrosion prevention capabilities, and the development of improved electro-optic technologies.

The development of chemical and biological defense technologies has been a priority in the military. Research in chemistry is essential in this effort, such as for the discovery of new countermeasures and improved detection capabilities.

The FY 2009 budget request would increase DOD basic research ("6.1") by 4 percent ($65 million), applied research ("6.2") would fall by 16 percent ($813 million), and advanced technology development ("6.3") would fall by 7.6 percent ($455 million), which would likely decrease support for chemical research. Overall defense S&T funding is down 9.5 percent (down $1.2 billion; see Table II-2). However, removing scientific earmarks and focusing only on agency-approved or peer-reviewed research reveals that DOD is proposing to increase this account by $1 billion over the next five years. (For more on DOD, see Chapter 5.)

ENVIRONMENTAL PROTECTION AGENCY (EPA)

At EPA, the Office of Research and Development (ORD) supports most of the fundamental research that underpins the Agency's efforts to protect public health and the environment. Because chemistry plays a central role in much of EPA's decision-making processes and in solving the nation's environmental problems, ORD engages in a great deal of chemical research. These efforts include addressing concerns about potentially harmful components of air, water, and food and the development of green chemistry and engineering approaches for less environmentally damaging processes and materials.

Overall, EPA's budget would continue a trend of declining funding for the agency. The President's budget funds ORD at $541 million, a decrease of $7 million, or 1.3 percent. The Administration has virtually

flat-funded the overall EPA Science & Technology (S&T) account, proposing $764 million for FY 2009, an increase of $4 million (0.5 percent) over FY 2008. The EPA's S&T account supports laboratories and programs that contribute, in many cases, to multiple goals and objectives across the whole of EPA. The President's budget request would cut 1.3 percent ($61 million) of extramural research funded through the Science to Achieve Results (STAR) program. This would have detrimental implications for research in the green chemistry field.

DEPARTMENT OF ENERGY (DOE)

DOE supports fundamental research in the chemical sciences that seeks to improve the cost effectiveness and environmental impact of the production and consumption of energy and energy-related products. DOE, through the Office of Science, is the sole supporter of heavy-element chemistry and the primary supporter of homogenous and heterogeneous catalysis, photochemistry, radiation chemistry, separations and analysis and gas-phased chemical dynamics. Most chemistry research at DOE is supported through two Office of Science programs: Basic Energy Sciences (BES) and Biological and Environmental Research (BER). For the third year of the American Competitiveness Initiative the Administration proposes a $4.7 billion budget for the Office of Science, an increase of $749 million or 18.9 percent. Additionally, BES, steward of the National Laboratories, will receive a $298 million (23.5 percent) increase to $1.6 billion, and BER would increase by 4.4 percent to $569 million (see Table II-11).

The weak FY 2008 enacted budget will cause significant shortfalls in both research grants and facility improvements, both in delayed completion of projects and reduced facility run times. Chemistry-specific facilities, such as the Linac Coherent Light Source, based at Stanford Linear Accelerator Center, the five NanoScale Science Research Centers, and the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory will all experience construction funding shortfalls that could delay completion up to one year.

The Linac Coherent Light Source, a world-class facility based at Stanford Linear Accelerator Center, will provide laser-like radiation in the x-ray region of the spectrum. This facility will provide 10 billion times the brightness of current coherent light sources, giving insight as never before into catalysis, chemical processes, protein folding, and

molecular assembly. Five NanoScale Science Research Centers (NSRCs) will eventually be operational at Oak Ridge, Lawrence Berkeley, Sandia, Brookhaven, and Argonne National Labs. The NSRCs are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale level. They are designed to enable the nanoscale revolution by situating multiple research disciplines, multiple techniques, and a wide variety of state-of-the-art instrumentation in a single building. The Spallation Neutron Source (SNS) at Oak Ridge National Laboratory, the world's most powerful neutron scattering facility, is tentatively scheduled to open in 2009, barring funding-related construction delays. SNS will be the world's most powerful neutron scattering facility. The Office of Science is also beginning work on Energy Frontier Research Centers, designed to engage the nation's intellectual and creative talent to tackle basic energy challenges in fields such as solar energy utilization, solid state lighting, catalysis for energy, and superconductivity. The centers are an outgrowth of BES workshops which targeted areas of need in the field of basic energy research.

NATIONAL INSTITUTES OF HEALTH (NIH)

The FY 2009 request for NIH is $29.5 billion, reflecting no change from FY 2008. As the principal supporter of biomedical research in the United States, NIH is a significant source of new discoveries that are leading to longer, healthier lives. The chemical sciences play a critical enabling role in these efforts, and accordingly NIH supports research in the chemical sciences to further the molecular understanding of disease and illness and to develop new techniques to advance biomedical research.

Increasingly, the ability to respond to new health challenges, such as anthrax and drug-resistant forms of tuberculosis, and to combat enduring afflictions such as diabetes, cancer, and Alzheimer's disease, relies on an understanding of human systems and diseases at molecular levels. Much of this understanding has accumulated through years of investigation in basic chemical and biological phenomena through the support of the National Institute of General Medical Sciences (NIGMS) and the National Center for Research Resources (NCRR).

NIGMS provides non-disease-specific basic research and training that complement advances in other NIH institutes. NIGMS is the largest single source of chemistry funding within NIH, traditionally providing approximately two-thirds of NIH's support for academic research in

chemistry and one-third of its support in biochemistry. Within NIGMS, the Division of Pharmacology, Physiology, & Biological Chemistry carries out vital chemical research into both pharmacology and the chemistry of life. The Administration requests $1.9 billion for NIGMS in FY 2009, a 0.3 percent increase (see Table II-9).

NCRR supports the state-of-the-art research infrastructure to provide high-quality biomedical research. Of particular importance to chemical research is the Shared Instrumentation Grants (SIG) program, which provides the necessary instrumentation to pursue research opportunities. The NCRR budget would increase 1.0 percent to $1.2 billion in FY 2009.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST, through its intramural and extramural programs, delivers the underlying technological capabilities for areas of chemical processing and research, from nanotrace analyses and clinical testing to synthesis and catalysis. The Administration's budget would reduce funding in FY 2009 by 15.6 percent to $638 million, due largely to the proposed elimination of the Technology Innovation Program (TIP) and Manufacturing Extension Partnerships. TIP supports high-risk, high-reward research in areas of critical national need and was created by passage of the America COMPETES Act last year. For NIST laboratories under Scientific and Technical Research Services (STRS), there is a strong FY 2009 request of $535 million, a 21.3 percent increase over FY 2008 final appropriations. This increase would address critical infrastructure and national security needs and support chemical research.

Researchers at NIST's Chemical Science and Technology Laboratory (CSTL) focus, in part, on the research and technology needs of the U.S. chemical industry. CSTL is part of the larger NIST laboratories program. NIST laboratories provide impartial expertise, test methods, and best-in-the-world calibration services that maximize efficiency, promote trade, and ensure confidence in the growing number of precision measurements needed for a variety of sectors including electronics, automotive, aerospace, food processing, and health care. In addition, the laboratories produce standard reference materials and data needed to achieve lower detection limits, and improve the quality, productivity, and efficiency of chemical measurements. The laboratories also play an integral role in nanotechnology by developing measurements and standards for nanodevices, nanomagnetics, and nanocharacterizations.