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Chemical Sciences in the FY 2014 Budget

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Highlights

- The Obama Administration is proposing increases for chemistry R&D at the National Science Foundation (NSF), the Department of Energy's (DOE) Office of Science, and the National Institute of Standards and Technology (NIST).

- At the National Institutes of Health (NIH), support for R&D on non-disease-specific areas and supporting technologies would hold steady, or decline once inflation is factored.

- The Materials Genome Initiative, started in June 2011, aims to develop a substantial new material science infrastructure including data sharing and new experimental and computational tools in order to halve the time it takes for newly discovered materials to reach the market. The initiative includes chemical research efforts at NSF, DOE Office of Science, and NIST.

Introduction

Chemistry is a fundamental science that underpins advances in areas as diverse as understanding disease pathways and designing new drugs, finding new materials and chemical processes to develop next-generation energy systems, and improving standards and measurement technologies to enhance American competitiveness. For FY 2014, the White House is emphasizing revitalizing the U.S. manufacturing sector, cultivating clean energy, improving health care outcomes, managing environmental resources, and addressing global climate change. Chemistry, as an enabling science, is well-represented throughout the agencies participating in these cross-cutting Administration priorities. Federal funding also plays a crucial role in educating the next generation of chemical scientists and engineers

and supporting the design and maintenance of state-of-the-art instruments and user facilities in the U.S.

Table 1. Selected Chemistry R&D in the Federal Budget
(budget authority in millions of dollars)

	FY 2012 Actual	FY 2013* Estimate	**FY 2014 Budget**	Change FY 12-14* Amount	Change FY 12-14* Percent
National Science Foundation	5,705	5,478	**6,240**	534	9.4%
Math and Physical Sciences	*1,309*	*1,256*	***1,386***	*77*	*5.9%*
Chemistry	*234*	--	***254***	*20*	*8.4%*
Materials Research	*294*	--	***315***	*20*	*6.9%*
Env Protection Agency	568	532	**560**	-8	-1.4%
Science & Technology	*544*	*509*	***537***	*-7*	*-1.3%*
Department of Energy					
Office of Science	*4,463*	*4,239*	***4,744***	*281*	*6.3%*
Basic Energy Sciences	*1,645*	*1,604*	***1,862***	*218*	*13.2%*
Bio and Environ Research	*592*	*579*	***625***	*33*	*5.6%*
ARPA-E	255	226	**345**	90	35.3%
National Institutes of Health	30,012	28,458	**30,490**	478	1.6%
General Medical Sciences	*2,426*	*2,300*	***2,401***	*-25*	*-1.0%*
NCATS	*574*	*545*	***666***	*91*	*15.9%*
Biomed /Bioeng	*338*	*320*	***339***	*1*	*0.3%*
NIST Discret R&D	557	588	**696**	139	25.0%

Source: Agency budget justifications and other budget documents.
All figures rounded to the nearest million. Changes calculated from unrounded figures.
* - AAAS estimates of funding in FY 2013.

The Obama Administration has signaled continued strong support for science by proposing increases for chemistry and other physical sciences even as it reduces the overall size of the federal budget. For key supporters of the physical sciences – NSF, DOE's Office of Science, and NIST – the budget would provide a total of $13.5 billion, an increase of 8 percent above FY 2012 funding levels.

Comparisons between the FY 2014 request and FY 2012 funding below are not adjusted for inflation.

National Science Foundation (NSF)

Within NSF, chemistry research is funded in the Mathematical and Physical Sciences (MPS) Directorate. The NSF Chemistry Division (CHE) funds about 50 percent of all chemical research at NSF. The

remainder of chemical research support is split between the Division of Materials Research (DMR), the Engineering Directorate, the Geosciences Directorate, and the Office of Integrative Activities.

NSF has requested $222.8 million for the Science, Engineering and Education for Sustainability (SEES) initiative for FY 2014. This NSF-wide effort to achieve an environmentally and economically sustainable future includes foci such as sustainable energy pathways, sustainable materials and chemistry, and sustainability research networks. CHE would continue the Sustainable Chemistry, Engineering, and Materials (SusChEM) program, one of five programs within SEES.

Another NSF-wide initiative, the Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) includes a "matter by design" computational infrastructure component that has great potential to support chemists. CHE and DMR would each contribute $3.5 million to CIF21 in FY 2014.

MPS investments in Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) are comprised of two components: Designing Materials to Revolutionize and Energize the Future (DMREF) and Advanced Manufacturing. DMREF is part of the national, multi-agency Materials Genome Initiative. It aims to accelerate the discovery and deployment of new, useful materials through integration of theory and computation, experiment, and data mining. DMR would lead the activity and would contribute $15 million, while CHE would partner, contributing $9 million. Advanced Manufacturing at NSF is closely entwined with the chemical enterprise and its quest for new and more efficient chemical production. Both CHE and DMR have budgeted $20 million for Advanced Manufacturing in FY 2014.

Environmental Protection Agency (EPA)

Chemistry is fundamental to EPA's efforts to protect public health and the environment. EPA supports scientific research and environmental monitoring to better understand environmental, health, and safety issues, and to make effective regulatory decisions. Both the overall EPA budget and EPA Science and Technology funding would decline under the FY 2014 Administration request. The S&T budget of $537 million represents a 1.4 percent decrease from the FY 2012 $544 million budget, while EPA's

total R&D budget would decline 1.4 percent, from $568 to $560 million.

Most of EPA's chemistry research is supported through the Office of Research and Development (ORD). ORD's budget covers five strategic goals: Air, Climate, and Energy; Safe and Sustainable Water Resources; Sustainable and Healthy Communities; Chemical Safety for Sustainability, Human Health Risk Assessment; and Homeland Security. While there are chemistry contributions from all divisions, the division with most relevance to the chemical enterprise is Chemical Safety and Sustainability (CSS), which would receive $95 million in FY 2014, a 1.6 percent increase over FY 2012.

Department of Energy (DOE)

DOE's Office of Science is the largest federal supporter of research in the physical sciences, driving advances in energy production, efficiency, conservation, and alternative energy sources. Within the Office of Science, chemistry research is primarily supported through two programs: Basic Energy Sciences (BES) and Biological and Environmental Research (BER).

Over half of the BES budget supports state-of-the-art user facilities. The remainder is allocated to research opportunities in catalysis, nanotechnology, high-speed computing, hydrogen, biomass, and other areas vital to solving global energy and climate challenges. BES funds research in more than 170 academic institutions in 50 states through awards to individual scientists and small groups, Energy Frontier Research Centers, and multi-disciplinary Energy Innovation Hubs. The FY 2014 budget would continue to support the 46 Energy Frontier Research Centers and two Energy Innovation Hubs (Fuels from Sunlight and Batteries and Energy Storage). In FY 2014, the five-year performance period for all existing EFRCs will conclude. Existing as well as new EFRCs would be able to compete for a new 5-year grant, and one-time funding in the amount of $28.9 million is requested to fully forward fund some of the new/renewal EFRC awards.

As part of the materials and chemistry by design effort, BES funding would provide for the development of computational methods and software tools for the simulation of light harvesting and conversion of solar energy into electricity.

The BER program supports leading-edge science on the human genome, medical imaging, climate change, pollution prevention and clean-up, and environmentally sound energy production. BER funds three Bioenergy Research Centers, the Joint Genome Institute, and the Environmental Molecular Sciences Laboratory. The FY 2014 request for BER is $625 million, a 5.6 percent increase over FY 2012 funding of $592 million.

In addition to vital research within the Office of Science, DOE's FY 2014 request would fund the Advanced Research Projects Agency–Energy (ARPA-E). This high-risk, high-reward energy research program is designed to fund transformational energy research using a nimble and flexible framework modeled on the Defense Advanced Research Projects Agency. The Administration requests $345 million for ARPA-E R&D, a 35.3 percent increase from FY 2012 funding of $255 million.

National Institutes of Health (NIH)

NIH is the largest supporter of biomedical research in the world, conducting cutting-edge, peer-reviewed research to achieve longer, healthier lives through prevention strategies, early detection, and more effective treatment of diseases. The FY 2014 NIH request represents an increase of 1.6 percent, continuing a negative trend for the NIH budget: after adjusting for inflation, the agency's budget has decreased 6.1 percent since FY 2004. The overall decrease plummets to 18.4 percent when adjusted for scientific purchasing power using the Biomedical Research and Development Price Index.

Much of the basic chemistry research that underpins biomedical progress takes place within the National Institute of General Medical Sciences (NIGMS), the National Institute of Biomedical Imaging and Bioengineering (NIBIB), and the National Center for Advancing Translational Sciences (NCATS). NCATS was established in December 2011, replacing the National Center for Research Resources (NCRR).

NIGMS is the largest single funder of chemistry research within NIH, supporting non-disease-specific basic research that lays the foundation for an array of advances in prevention, diagnosis, and treatment. The NIGMS budget would decrease 1 percent, from $2.43 million in FY 2012 to $2.40 million in the FY 2014 request. Two key NIGMS divisions for chemistry

R&D, Cell Biology and Biophysics (CBB) and Pharmacology, Physiology, and Biological Chemistry (PPBC), are each targeted with slight increases of 1.1 percent relative to FY 2012. CBB, which advances technologies for targeted therapies and diagnostics, would receive $569 million. PPBC, which improves understanding of human biology and supports new diagnostics and therapeutics, is slated for $405 million under the FY 2014 request.

NIBIB supports basic research, biomedical career development, and cutting-edge technologies. Its budget would increase just 0.3 percent to $339 million in the FY 2014 request.

NCATS catalyzes the development of innovative pipelines to more effectively translate scientific discoveries into therapeutic and diagnostic products for a wide range of diseases. Much of NCATS pre-clinical research has a strong chemistry component, including the Probe Development and National Chemical Genomics Center, Therapeutics for Rare and Neglected Diseases, and Tox21, an interagency chemical toxicity screening initiative that is a combined effort with the Food and Drug Administration, EPA, other branches of NIH, and industry. The FY 2014 request for NCATS is $666 million, 15.9 percent growth over FY 2012.

National Institute of Standards and Technology (NIST)

NIST's mission is to promote American industry's innovation and competitiveness by supporting R&D to improve measurement methods and standards. By advancing extremely accurate measurement technology, NIST enables universal quality-control technologies that undergird industrial productivity, efficiency improvements, and faster product development. NIST also plays a critical role in advancing public health and safety, environmental progress, and national security.

While chemical, materials, and chemical engineering research can be found throughout NIST, the core of chemical support is funded by Scientific and Technical Research and Services (STRS), and specifically in the Material Measurement Laboratory (MML). The FY 2014 budget request would increase funding for NIST's intramural laboratories to $696 million, a 25 percent increase over FY 2012 enacted levels. STRS would expand NIST research in areas such as smart manufacturing, nano-manufacturing, and bio-manufacturing. The NIST budget request includes a one-time $1 billion

investment to launch the National Network for Manufacturing Innovation (NNMI). The one-time request would require a separate legislative vehicle to authorize funding.

The budget would also provide $21 million for the Advanced Manufacturing Technology Consortia program, a public-private partnership that would identify long-term industrial research needs and fund research at universities, government laboratories, and businesses to meet those needs.