

SCIENCE AND TECHNOLOGY IN THE BUDGET

Innovation is the backbone of our American economy and well-being. Since World War II, nearly half of Gross Domestic Product (GDP) growth has resulted from investments in research and development (R&D). Federal support of R&D opens new areas of technology and, ultimately, provides a path to long-term economic growth because of high-impact, fundamental discoveries that spawn entire industries. The federal government provides vital evaluations of the safety and the environmental impact of technology. Federal support of R&D increases national security and provides knowledge to inform local, state and national decisions by providing the means to weigh options and to evaluate their effectiveness.

Our society has developed a social contract that recognizes that scientific and technical progress occurs through research and development investment sustained over time. Government-funded R&D, in conjunction with private industry support, boosts job creation. These efforts ensure that a highly educated, skilled workforce is available and able to apply their skills in the private sector and beyond to develop products, use them safely and advance the economy.

Federally-funded universities and government laboratories generally work on new technologies in the earliest stages while industry brings more mature advances to the marketplace. Curiosity-driven and high-risk, high impact research has thus produced discoveries spawning entire new industries. Such long-term work, often decades in duration, needs to be supported by government funding because the time frames needed to complete the work extends beyond those reasonable for industry to consider.

A Path to Predictable and Sustained Federal Funding for R&D

Given the long-term nature of research, predictable and sustained federal funding is critical to our technology driven economy, but federal research support as a percentage of GDP has shrunk over the past few decades, negatively impacting many areas of science and technology (S&T). The impact of these cuts has been exacerbated by uncertainty in the federal budget decision process. Unpredictable budgets lead to a high turnover of trained scientists and a loss of the operational infrastructure critical for success.

The Society urges policymakers to invest in long-term economic growth by setting funding levels that stabilize the fraction of U.S. GDP devoted to federally supported R&D. To ensure the scientific foundation is laid for the economy of the future, the United States must reverse the path that has taken us to our current 40-year low of less than 0.9 percent of GDP invested in federal R&D. The U.S. is in 10th place among Organization for Economic Cooperation and Development nations in overall R&D investment as a percentage of GDP. Shrinkage in the overall research enterprise is undermining U.S. S&T leadership, economic competitiveness, and job creation. ACS believes that the best way to achieve American preeminence is to bolster R&D investments. The Society therefore recommends that the federal government's support of R&D returns to overall levels nearer the 1.2 percent invested during the 1970s and 1980s, when the scientific foundation was laid for today's technology-based economy.

Making the Most of Federal Research Dollars

Federal funding models

ACS supports federal agency efforts to experiment with adaptable and flexible grant structures to maximize the impact of S&T investments. One example from the National Institutes of Health is

The American Chemical Society (ACS) Board of Directors Committee on Public Affairs and Public Relations adopted this statement on behalf of the Society at the recommendation of the Committees on Chemistry and Public Affairs, Environmental Improvement, Corporation Associates, and the Society Committee on Education. ACS is a non-profit scientific and educational organization, chartered by Congress, with nearly 157,000 chemical scientists and engineers as members. The world's largest scientific society, ACS advances the chemical enterprise, increases public awareness of chemistry, and brings its expertise to state and national matters.

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introduction of longer grants to fund laboratories, rather than specific projects. Programs that involve interdisciplinary teams of researchers on high-priority topics, such as the Department of Defense's Multidisciplinary University Research Initiatives, the Department of Energy's Energy Frontier Research Centers and Energy Innovation Hubs also deserve attention as models for other agencies.

Such changes are expected to improve research funding predictability, enhance the quality of graduate student training and enable greater scientific achievements with the available funding levels. The Society also supports a distribution of funding to foster a healthy balance between new and established investigators.

Scientific Impact

Translating discoveries to commercial applications

Government support of curiosity-driven research is essential in the decades-long process of providing American industry with the science to develop products to enable economic growth. However, ACS also encourages successful, later-stage technology transfer and development programs such as the Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Small Business Investment Companies (SBIC), and Small Business Administration microloan programs, DOE's Energy I-Corps as well as NSF's Innovation Corps among others. Federal support must continually be refined. Novel methods for targeting federal support toward innovation, such as the Advanced Research Projects Agency-Energy (ARPA-E), are encouraged. New organizational designs promoting collaboration across the chemical enterprise, such as the National Network of Manufacturing Institutes, should be supported, given time to fulfill their mission, evaluated and refined to insure fulfillment of their mission.

Funding for equipment and methods development

World-class research is dependent on access to world-class tools. Funding of shared facilities, methods development, equipment, indirect costs associated with the conduct of funded research, and other resources is essential for our scientific competitiveness. ACS encourages support for programs that include methods and standards development such as those at the National Institute of Standards and Technology (NIST) and the Department of Energy (DOE) National Laboratory User Facilities, which serve as important resources for university, government and industry research.

Science supports national needs

Government plays an essential role in targeting R&D dollars to areas of critical need, including national security, energy production, food growth, and public health. Science is essential to all such endeavors, and ACS supports continued, targeted R&D programs, including the Materials Genome Initiative, advanced manufacturing and BRAIN (Brain Research through Advancing Innovative Neurotechnologies) initiatives. Research funding also enables the specialized training of scientists and engineers necessary for next generation advances and required to train future generations.

A Strong and Diverse Workforce

A critical function of federal S&T support is to educate the future workforce, including scientists and engineers. ACS supports education programs to develop a workforce with scientific depth of knowledge, breadth in skills, an ability to work in teams, commitment to work safely, and learning adaptability for future changing times. Science, technology, engineering and mathematics (STEM) education programs develop essential technological and analytical skills for nearly every sector of our economy. A diverse, STEM-educated workforce is essential for the S&T enterprise. Creative ideas emerge when scientists come from multiple backgrounds and work in multidisciplinary teams. The Society supports programs that broaden participation of underrepresented groups in STEM fields. Allocations to the NSF Education and Human Resources Directorate should be proportional to those provided for NSF research programs. The Society encourages support of the Established Program to Stimulate Competitive Research (EPSCoR) program for building S&T workforces and infrastructure in U.S. states where federal R&D funding is relatively low. We suggest that federal agency STEM investments be coordinated and complementary, while also meeting the unique mission of each office. The Society notes that the role of science is to inform and that the role of policy is to decide. Thus, ACS supports efforts to train scientists with an understanding of the economic, legal, regulatory

and other social factors that are considered in decision making to be better able to communicate results of research and development, thereby helping to meet societal needs.