

## SCIENCE AND TECHNOLOGY IN THE BUDGET

Fundamental and applied research and development (R&D) enable the innovation needed to support the American economy and maintain the well-being of the nation. Innovation is critical to national security, leads to the development of new products and industries, provides the knowledge needed for decision making, and supports a robust economy. Both federal support and contributions from private industry are required. Fundamental research emphasizes discovery, applied research brings discoveries to the point of use, and development leads to products and processes for widespread use. The entire R&D process is needed for innovation, exemplified by the contributions of all areas of basic chemistry and biomedical research to the identification of new drugs, vaccines, and treatments for diseases. Broad, sustained support of R&D, including associated educational programs, provides benefits in the form of a well-trained workforce, new materials, and new processes for national security, energy storage and supply, sustainability, agriculture, food, medicine, epidemiology, environmental impact, and the development of fundamental methods as platforms for multiple applications.

Government funding of fundamental and applied research leads to discoveries that have historically spawned new industries. The initial development often relies on government funding since the time frame from inception to return on investment routinely extends beyond that which is reasonable for industry to bear. Unfortunately, data in the National Science Board's *Science and Engineering Indicators* show that federal research support of basic and applied R&D as a percentage of gross domestic product (GDP) has plateaued in recent decades, such that total U.S. R&D funding has fallen behind that in the East Asia region. The *Indicators* also document that federal support of research and particularly the critical development phase has steadily decreased. Taken together, these point to a significant threat to American scientific leadership, competitiveness, and innovation.

Sustained and predictable federal funding can exert an especially strong impact on productivity in several areas. Federally-funded fundamental and applied research initiates and fosters new discoveries and their translation towards useful products. Additional federal support can respond to development shortfalls, even when the development work lacks a short-term payoff. Federal funding of shared facilities, including government laboratories, enables world-class research with the state-of-the-art tools, methods, and equipment essential for our scientific leadership. Federal funding of regulatory agencies is key to ensuring that new products and processes are safe to both human health and the environment. Federal funding also needs to be informed by strong peer review and wider discussions, such as from the United Nations Sustainable Development Goals and the deliberations of the National Science Board, the National Research Council, and the National Academies.

Creative ideas emerge when scientists from multiple backgrounds collaborate on interdisciplinary teams. A diverse, STEM-educated workforce provides a crucial foundation for the science and technology enterprise. Research and education funding, including at the state and local level, incentivizes U.S. students to pursue STEM fields and enables the specialized training and retention of scientists and engineers in the U.S. who go on to create and catalyze advances and train future generations of innovators. Federal programs that ensure that the opportunities and gains from education are distributed equitably across society in our nation also support diverse learners and the wider public. Support that encourages collaboration, including with international partners, is also important to ensure that R&D draws on the widest possible knowledge base.

ACS advocates that the federal science and technology budget increases federal funding of R&D to a level that places the U.S. at the global forefront. The funding should include provisions for:

- Fundamental and discovery-based research;
- Applied research programs to bridge discovery and development;
- Development and technology-transfer programs;
- Shared facilities including those that provide access to advanced, novel instrumentation and testing, and where methods and standards are developed;
- The incorporation of safety and environmental sustainability factors into research and technology development programs; and
- Dissemination of results and assessments about the benefits of the federal investment in science and technology to multiple stakeholders.

ACS advocates that the federal budget process:

- Uses multi-year appropriations with rolling, long-term investments to enable increased predictability and stability;
- Supports nimble, short-term efforts directed at emerging areas of concern as well as longer-term efforts to tackle large-scale societal challenges;
- Ensures coordination and complementarity in STEM investments among federal agencies, including multi-agency grants in cases of mission synergy;
- Encourages establishment of long-term, collaborative teams of interdisciplinary researchers to address complex, evolving national challenges;
- Requires the consideration of ethical, safety, economic, legal, regulatory, and economic factors in all aspects of R&D and in student training; and
- Supports an excellent, diverse, dynamic, STEM workforce at the national, state, and local level with attention to:
  - Groups that are historically under-represented in STEM;
  - Strengthening of programs such as the National Science Foundation's (NSF) Established Program to Stimulate Competitive Research (EPSCoR) and various National Institutes of Health (NIH) Bridge programs; and
  - Training scientists and engineers with a depth of knowledge and interdisciplinary and collaborative, skills; and
  - Providing continuing education and retraining to ensure the STEM workforce meets rapidly evolving needs and opportunities.

REFERENCE: <https://nces.nsf.gov/pubs/nsb20221/u-s-and-global-research-and-development>