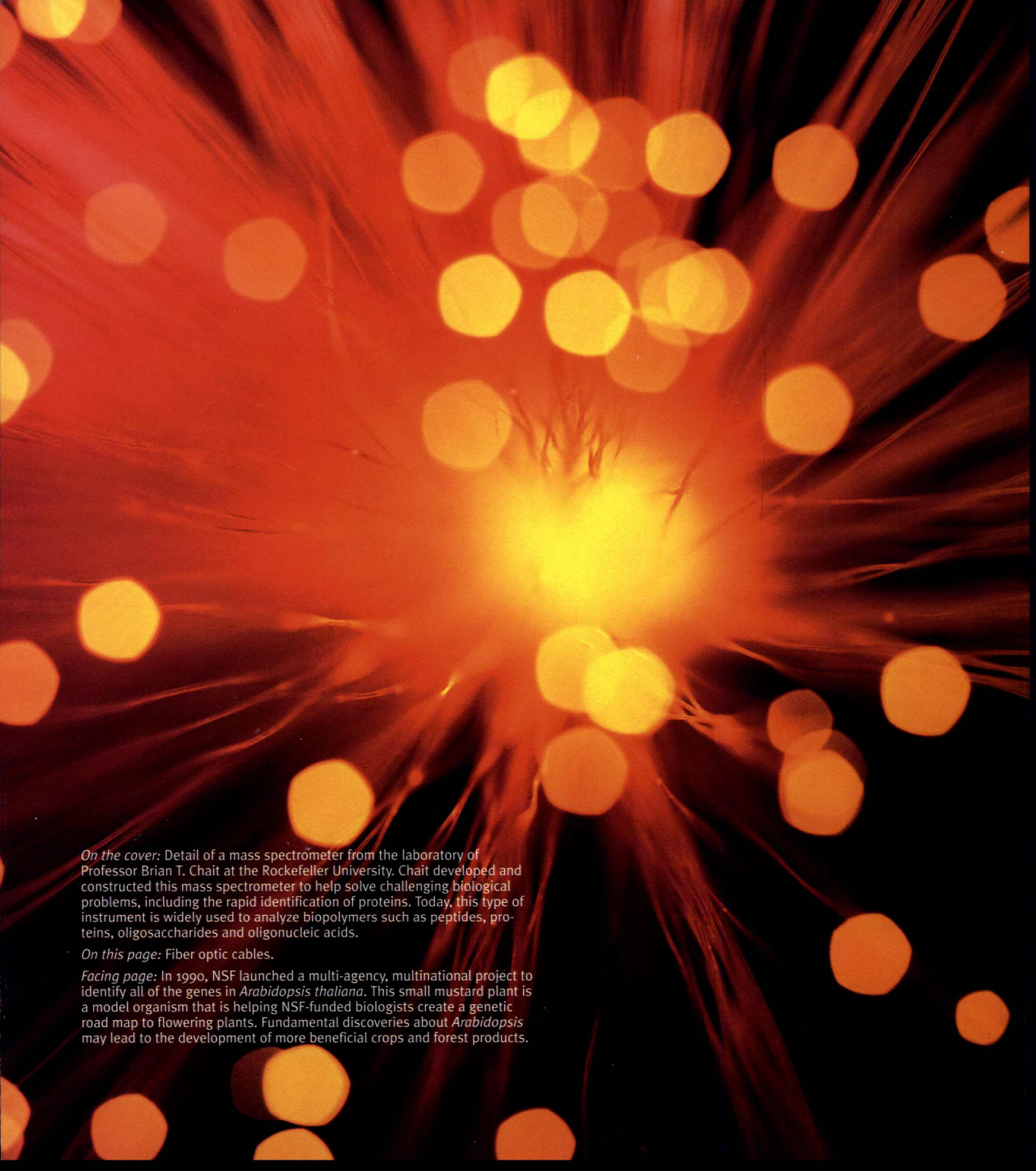
National Science Foundation

Where
Discoveries
Begin



On the cover: Detail of a mass spectrometer from the laboratory of Professor Brian T. Chait at the Rockefeller University. Chait developed and constructed this mass spectrometer to help solve challenging biological problems, including the rapid identification of proteins. Today, this type of instrument is widely used to analyze biopolymers such as peptides, proteins, oligosaccharides and oligonucleic acids.

On this page: Fiber optic cables.

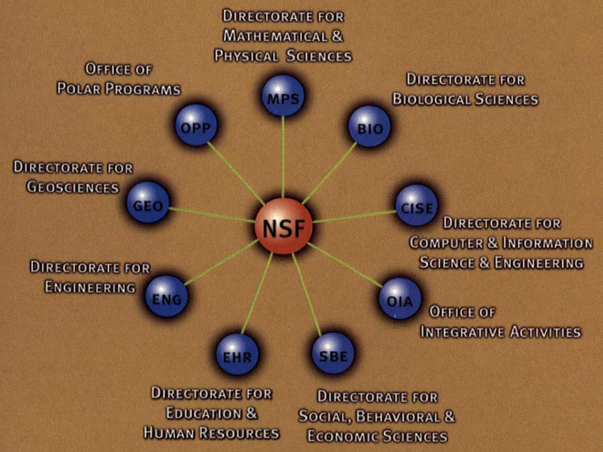
Facing page: In 1990, NSF launched a multi-agency, multinational project to identify all of the genes in *Arabidopsis thaliana*. This small mustard plant is a model organism that is helping NSF-funded biologists create a genetic road map to flowering plants. Fundamental discoveries about *Arabidopsis* may lead to the development of more beneficial crops and forest products.

What do camcorders, magnetic resonance imaging (MRI), Doppler radar, and the Internet have in common? Beyond the fact that they have enriched people's lives, these innovations share a common parentage: they are the results of public investments in science and engineering made by the National Science Foundation (NSF). Created in 1950, NSF promotes and advances progress in science and engineering research and education in the United States. We, at the National Science Foundation, have a vision of science and engineering in service to society. We invest in and across all fields of science, mathematics, and engineering. Over the years, our investments have led to: the creation of new jobs and industries; the development of life-saving technologies and other advances in health care; biotechnology that increases agricultural yields to feed a growing world population; more effective approaches to teaching science, mathematics, and engineering; an ongoing revolution in the way people communicate; and a better understanding of the planet and the universe.

Looking ahead, we will continue to invest in the most promising areas of science and engineering research and education. We can be certain that the results will enhance the nation's future in profound, and possibly unimaginable, ways.

Who We Are

The Foundation's science and engineering research and education programs are managed by the:



In both its research and educational support, NSF encourages the participation of underrepresented segments of the population, including minorities, women, and persons with disabilities.

NSF is a primary source of statistical information about science and engineering in the United States and worldwide. The Foundation's Division of Science Resources Studies conducts periodic surveys, compiles data, analyzes trends, and reports on science and engineering resources.

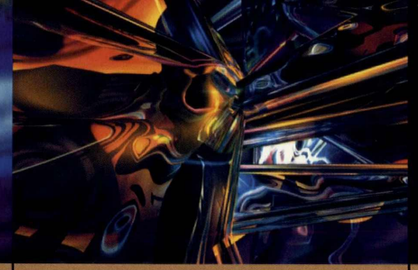
An Extraordinary Mandate

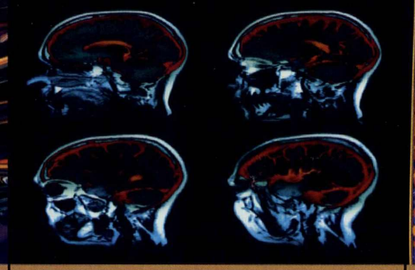
Federal investments in science and engineering research and education have a profound impact on society. They have made possible medical breakthroughs, enabled long-term economic growth, and addressed other societal needs. According to economists, up to half of U.S. economic growth during the past 50 years has come from technology and the science that supports it.

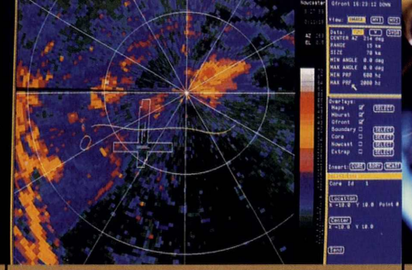
Among federal agencies that provide funds for basic research, only NSF is responsible for strengthening the overall health of U.S. science and engineering across all fields. In contrast, other federal agencies support inquiry focused on a specific mission, such as defense or energy. While NSF provides approximately four percent of what the federal government spends on research and development annually, NSF's budget funds nearly 25 percent of annual federal support for basic research at academic institutions.

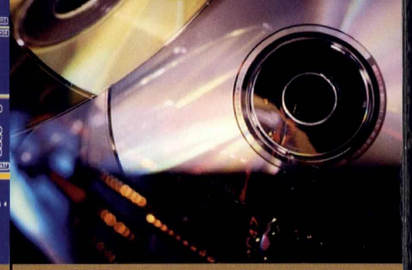
NSF also leads the nation's efforts to achieve excellence in science, mathematics, engineering, and technology education at all levels. We are committed to ensuring that the United States has a strong cadre of scientific leaders, a workforce that is scientifically and mathematically literate, and a public that fully understands basic concepts of science, engineering, and technology. Together with NSF's support for leading edge research, our educational activities are critical to sustaining the nation's economic strength and ensuring the well-being of all Americans in the 21st century.

Internet


Computer Graphics


MRI


Doppler Radar


Compact Disc

How NSF Provides Support

NSF funds extensive research, education and training activities.

Research Project Support

NSF-funded research activities range from support of individuals and small groups at a single institution to distributed centers with 20 or more participants scattered among several institutions. As the scale and scope of a project grow, so do NSF expectations in areas such as partnering, knowledge transfer, and education of the next generation of scientists and engineers.

Research Facilities Support

NSF provides funding for large, multi-user facilities that ensure researchers and educators have access to state-of-the-art tools and capabilities. NSF manages all U.S. research activities in Antarctica, providing logistic and other support to more than 600 scientists and their teams each year.

Education and Training

NSF funds reform of K-12 science and mathematics education in state, urban, and rural school systems. The Foundation also invests in comprehensive reform of undergraduate science, mathematics, engineering, and technology education. These efforts seek to prepare all students—not just science, mathematics, and engineering majors—for the demands of a highly technological society. At the graduate level, NSF is intensifying support for educating researchers and faculty beyond the boundaries of a single discipline, giving them access to modern research instrumentation, and preparing them for the increasingly international venue of research. NSF is also committed to improving public science literacy through projects that engage people of all ages and backgrounds in the excitement of discovery.

Investment Pay-Offs

Who benefits from NSF's investments in science and engineering? Everyone does. Without the Foundation, many innovations might not exist.

NSF's support of astronomers interested in maximizing their capacity for gathering light helped bring about the development of more sensitive charge-coupled devices. Today, these devices are found in virtually all **camcorders** and in medical equipment using **electronic imaging sensors**.

Few would have predicted that the study of the spin characteristics of basic matter would lead to improvements in health care. But the development of **Magnetic Resonance Imaging (MRI)**—a non-invasive technology used to diagnose many illnesses—was made possible by combining information about spin characteristics with research in mathematics and high flux magnets.

In genetics, Foundation support was critical to the discovery of the microbe that makes the polymerase chain reaction (PCR) possible. PCR has led to **DNA fingerprinting, enzymes for non-polluting detergents**, and other advances. Studies of plant genomes—NSF is a major supporter—produce **breakthroughs in biotechnology**, and these developments translate into higher crop yields, more environmentally friendly practices, and continued affordability of food.

NSF funded the National Center for Atmospheric Research and several universities to make important refinements to technologies associated with **Doppler radar**. Conventional radar provides information about the location and intensity of precipitation associated with a storm while Doppler radar adds the capability to discern air motions within a storm. Doppler radar facilitates the detection of near-ground wind shears, which are dangerous to aircraft. Doppler radar technology also enables meteorologists to forecast the location and severity of weather with greater accuracy, resulting in improved public safety.

In 1985, the Foundation established NSFNet to carry electronic traffic to four NSF-supported supercomputer centers. We also encouraged the development of regional networks to connect with the backbone NSFNet. These pioneering efforts were instrumental to the creation of the **Internet**. Today, this global network of networks represents possibly the most dramatic transfer of federal research to commercial application, spurring the growth of information technologies and new industries.

A New Age of Exploration

These examples represent only a fraction of our success stories. As NSF invests in promising research and education, we will continue to expand the possibilities for dramatic advances in all areas of science and engineering knowledge.

NSF by the Numbers

Approximately $4 billion	Annual Budget
3.8 percent	Portion of annual federal spending for research and development.
23 percent	Share of federal support for basic research conducted at academic institutions.
40 percent	Share of federal funding for basic research in the physical sciences that is performed at universities and colleges.
46 percent	Share of federal funding for basic research in engineering that is performed at universities and colleges.
2,000	The number of colleges, universities, elementary and secondary schools, nonprofit institutions, and small businesses where NSF funds projects in a year.
10,000	The number of new awards funded by NSF in a year.
19,000	The number of awards funded by NSF in a year.
30,000	The number of proposals that are competitively reviewed annually.
34,000	The total number of outstanding students in science, mathematics, and engineering who have received support through NSF's Graduate Research Fellowship Program since 1952.
50,000	The number of scientists and engineers who each year assist NSF's merit review process by evaluating proposals.
2000	The year that marks NSF's 50th anniversary.

Promoting Discovery

Informal Science Education

NSF is an independent federal agency. Our activities are guided by the National Science Board. Researchers and educators in all 50 states and in U.S. territories receive NSF support in the form of competitively awarded grants, contracts, and cooperative agreements. Competition is intense, with only about one-third of the 30,000 proposals we receive annually obtaining funds. We invest in the best ideas from the most capable researchers as determined by a rigorous merit review process. NSF evaluates proposals for research and education projects using two key criteria: **the intellectual merit of the proposed activity and the broader impacts of that activity on society.**

NSF staff are assisted by advisors from the academic community and industry. These leaders in their fields help us identify the areas that promise the greatest opportunities for breakthroughs. Our reliance on the science and engineering community in this manner enables NSF to be one of the most cost-efficient federal agencies. Internal operations, including staff salaries and expenses, consume only about five percent of our overall budget.

Besides funding proposals, the Foundation makes other investments in future discoveries. Since 1952, NSF's Graduate Research Fellowship Program has supported more than 34,000 outstanding students in science, mathematics, and engineering. Through the Experimental Program to Stimulate Competitive Research (EPSCoR), NSF partners with states to improve the academic research competitiveness of different regions of the country.

Evidence suggests NSF's investments—in people and the ideas they propose—result in world-class research. For example, NSF-supported researchers have collected 100 Nobel Prizes over the years, receiving recognition for work in the fields of physics, chemistry, physiology and medicine, and economics.

Investing in leading-edge research and education is, by nature, a future-oriented endeavor. It involves taking risks. Increasingly, it requires international collaborations and integrating knowledge across traditional disciplinary boundaries. Emphasizing areas judged to be the most likely to produce rich rewards for the science and engineering knowledge base and for society, NSF's investment portfolio includes:

Education for the 21st Century

NSF is committed to improving science, mathematics, engineering, and technology education at all levels, from pre-kindergarten through post-doctorate. We support increased opportunities for all students and workers to acquire the skills they will need in the 21st century. We foster the development of future world-class researchers and educators. Additionally, the Foundation funds efforts to build greater public awareness of how science and engineering enrich people's lives.

Advancing Information Technology

NSF supports activities that establish new directions for computer and information sciences, push the frontiers of high-end computing, and improve both reliability and performance of emerging technologies. We expect information technologies will play an ever-greater role in advancing all fields of science and engineering. The Foundation also funds work to broaden understanding of the various impacts on society of computing, networking, programming, information research, infrastructure development, and access.

Understanding Biocomplexity

NSF seeks to advance society's understanding of the functional interrelationships between biological entities, at all levels of organization, and the biological, chemical, geological, physical, and social environment, at all levels of aggregation. Biocomplexity research takes advantage of powerful new technologies, including genome sequencing and DNA-chips, new tools in computational analysis, mathematical and statistical modeling, and satellite-based imaging of the land and sea.

National Science Foundation
Celebrating 50 Years


Antarctic Penguin


Magnetar Computer Rendering


JOIDES Resolution


Digital Mammography


Romanian Water Spider


Signing Avatar

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