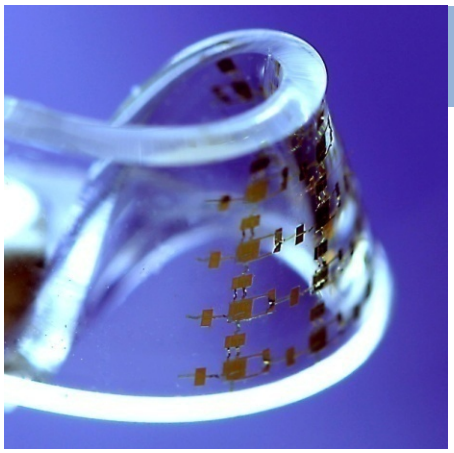


NSF FY 2011 Budget Request to Congress

The National Science Foundation Act of 1950 (Public Law 81-507) sets forth our mission: ***To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.***

NSF's Strategic Plan 2006-2011 defines our vision: ***Advancing discovery, innovation, and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering.***

The National Science Foundation is the only federal agency dedicated to the support of basic research and education across all fields of science and engineering. For 60 years, we have been exploring the frontiers of scientific knowledge and extending the reach of engineering by encouraging, identifying, and funding the best ideas and most promising people. The high-risk, potentially transformative investments we make generate important discoveries and new technology, create and train a dynamic workforce, and spark the curiosity and creativity of millions. Our investments in research and education help ensure that our Nation remains globally competitive, prosperous, and secure.

NSF's FY 2011 Budget Request is $7.424 billion, an increase of $551.89 million (8 percent) over the 2010 enacted level.

NSF Funding by Account
(Dollars in Millions)

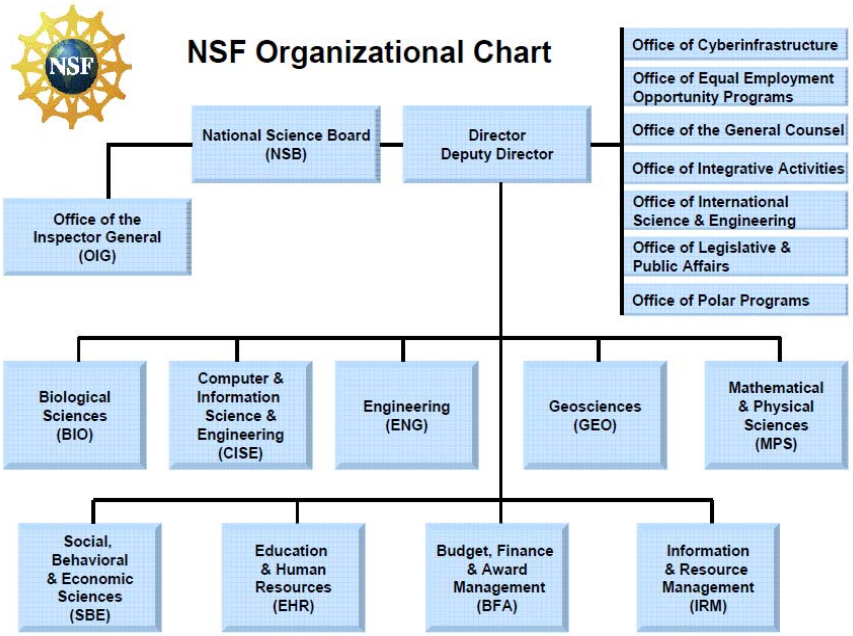
	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	Change over FY 2010 Estimate Amount	Change over FY 2010 Estimate Percent
Research & Related Activities[1]	$5,152.39	$2,062.64	$5,563.92	$6,018.83	$454.91	8.2%
Education & Human Resources	845.52	85.00	872.76	892.00	19.24	2.2%
Major Research Equipment & Facilities Construction	160.76	254.00	117.29	165.19	47.90	40.8%
Agency Operations & Award Management	294.09	-	300.00	329.19	29.19	9.7%
National Science Board	4.02	-	4.54	4.84	0.30	6.6%
Office of Inspector General	11.99	0.02	14.00	14.35	0.35	2.5%
Total, NSF	**$6,468.76**	**$2,401.66**	**$6,872.51**	**$7,424.40**	**$551.89**	**8.0%**

Totals may not add due to rounding.

[1] Funding for FY 2010 excludes a one-time appropriation transfer of $54.0 million to U.S. Coast Guard per P.L. 111-117.

Organization and Role in the Federal Research Enterprise

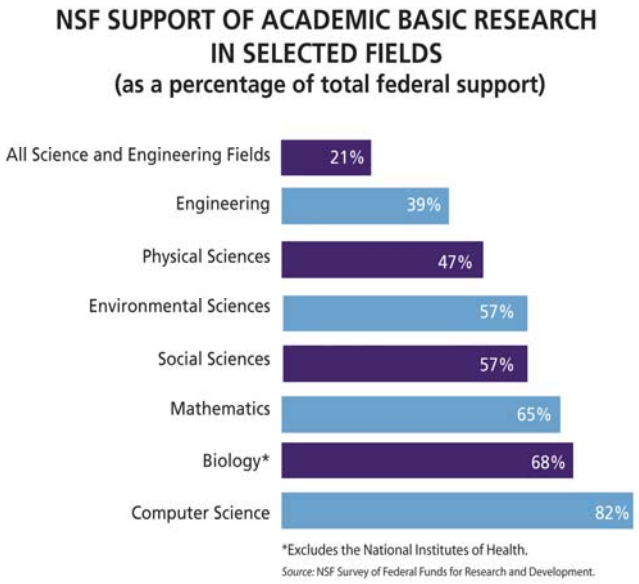
NSF-funded research is characterized by its breadth. NSF prioritizes the integration of education into its research programs, and takes into account the broader societal impacts of the work it funds, such as the training that students and young researchers receive in the research process, and the educational opportunities the work and its people can then provide to the larger community of K-16 students and teachers and the general public.



NSF's comprehensive and flexible support of meritorious projects with broad societal impacts enables the Foundation to identify and foster both fundamental and transformative discoveries within and among fields of inquiry. NSF has the latitude to support emerging fields, high-risk ideas, interdisciplinary collaborations, and research that pushes, and even transforms, the very frontiers of knowledge. In these ways, NSF's discoveries inspire the American public—and the world.

NSF's organization mirrors the major science and engineering fields, including the biological sciences; computer and information science and engineering; engineering; geosciences; mathematics and physical sciences; and social, behavioral, and economic sciences. NSF also carries out specific responsibilities for education and human resources, cyberinfrastructure, integrative activities, international science and engineering, and polar programs. The 25-member National Science Board sets the overall policies of the Foundation.

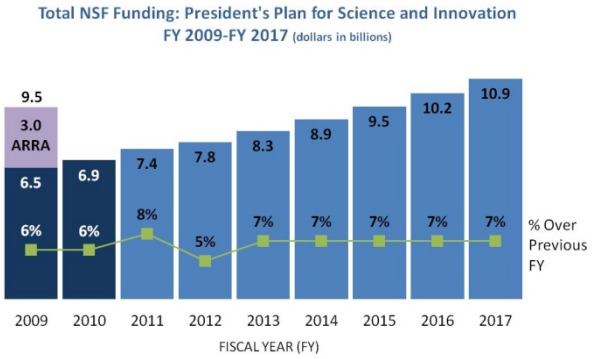
NSF's annual budget represents 21 percent of the total federal budget for basic research conducted at U.S. colleges and universities, and this share increases to 61 percent when medical research supported by the National Institutes of Health is excluded. In many fields NSF is the primary source of federal academic support.



National Innovation Strategy

NSF's contribution to the Administrations' Innovation Strategy stems from its longstanding role in strengthening the building blocks of American innovation. This begins with investments in fundamental research and education of the next generation of scientists and engineers. It also includes more focused research on topics that advance vital capabilities – such as sustainability, secure networks, and leading-edge technologies – and fostering and facilitating partnerships that reach across today's global innovation enterprises.

Restore American Leadership in Fundamental Research. Since innovation depends on the foundation of earlier investments, NSF's foremost responsibility in innovation is to continue to support fundamental research and education in all fields of science and engineering. The President's Plan for Science and Innovation aims to double the federal investment in basic research agencies. This investment will be vital to the effort to increase national research and development investments to 3 percent of Gross Domestic Product.



Educate the Next Generation with 21st Century Knowledge and Skills While Creating a World-Class Workforce. NSF's FY 2011 investments will reach nearly 215,000 scientists, engineers, teachers, and students who are directly engaged in work at the frontiers of learning and discovery. Priorities include:

- **RE-gaining our ENERGY Science and Engineering Edge (RE-ENERGYSE),** ($19.4 million) is located at the intersection of energy, environment, and human factors. It is a partnership between the Department of Energy (DOE) and the National Science Foundation that will help the Nation regain its leadership position in science and engineering by attracting and educating future scientists in the clean energy field. By 2015, RE-ENERGYSE would prepare up to 8,500 highly educated young scientists and engineers for clean energy careers and provide training for thousands of skilled clean energy technicians. NSF and DOE also have a continuing partnership in public awareness and outreach activities that support the goals of RE-ENERGYSE.

- **The Graduate Research Fellowship (GRF)** program, (16 percent increase to $158.2 million); an Administration priority, supports the development of the Nation's future scientists and engineers. FY 2009 marked the beginning of a growth trajectory to triple the number of new awards made each year to 3,000 by FY 2013.

Support Research for Next-Generation Information and Communications Technology, and Secure Cyberspace. While nobody can predict which of today's fundamental discoveries will become tomorrow's new products and processes, a number of NSF programs support the Strategy's goal to promote innovation. These include:

- **Science and Engineering Beyond Moore's Law,** (50 percent increase to $70.2 million). In 10 to 20 years, current silicon technology will reach the limits of Moore's Law – the empirical observation that computing power doubles roughly every 18 months. These transformational activities accelerate innovation and create partnering opportunities with the private sector and national laboratories.

- **Cyber-enabled Discovery and Innovation,** (3 percent increase to $105.5 million) supports transformative, multidisciplinary science and engineering research made possible by innovations and advances in computational concepts, methods, models, algorithms, and tools. Breakthroughs advance one or more of the three themes: From Data to Knowledge; Understanding Complexity in Natural, Built, and Social Systems; and Building Virtual Organizations.

- **Cybersecurity,** (11 percent increase to $144.6 million). NSF's basic research into usability, theoretical foundations, and privacy supports the aims of the Comprehensive National Cybersecurity Initiative.

- **Transformative Interdisciplinary Research in areas of national interest**. NSF's support of all science and engineering fields enables it to contribute to the jobs and industries of the future.
  - The intersection of the biological and physical sciences and the creation of a "bio-economy" that uses biotechnology to make "green" chemicals (as described in the National Academies' reports *Research at the Intersection of the Physical and Life Sciences* and *A New Biology for the 21st Century: Ensuring the United States Leads the Coming Biology Revolution*).
  - The integration of nanotechnology and/or cyber-physical systems with traditional manufacturing industries (as discussed in the National Economic Council's *Framework for Revitalizing American Manufacturing*).

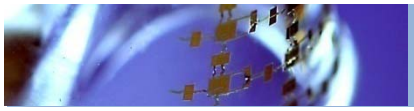
Encourage High-Growth And Innovation-Based Entrepreneurship, And Create Competitive Communities By Promoting Regional Innovation Clusters

Partnerships for Innovation, (109 percent increase to $19.2 million) bring together colleges, universities, state and local governments, private sector firms, and nonprofit organizations. In FY 2011, $12.0 million will be invested in a new "NSF Innovation Ecosystem" component, which aims to: increase the engagement of faculty and students across all disciplines in the innovation and entrepreneurship process; increase the impact of the most promising university innovations through commercialization, industry alliances, and start-up formulation; and develop a regional community that supports the "innovation ecosystem" around the university.

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR), (14 percent increase to $142.9 million). These business-centered programs support innovation research and build partnerships between the academic and industry sectors. They support the innovation economy by funding translational research at U.S. small businesses on topics that span the breadth of NSF scientific and engineering research and that reflect national and societal priorities.

Grant Opportunities for Academic Liaison with Industry, (0.4 percent increase to $18.6 million) seeks to increase partnerships between the academic and industrial communities and provide opportunities to accelerate innovation by strengthening the discovery knowledge base for a quicker translation of discovery to societal benefit. The program leverages its budget with support from other NSF academic research programs by a factor of four to one.

Centers programs, (9 percent increase to $313.8 million). NSF supports over 100 centers in seven interdisciplinary program areas. Centers exploit opportunities in science, engineering, and technology in which the complexity of the research problem or the resources needed to solve the problem require the advantages of scope, scale, duration, equipment, facilities, and students. Centers often leverage their activities through partnerships with academic institutions, national laboratories, industrial organizations, and/or other public/private entities, and via international collaborations, as appropriate.



Learning and Workforce Development

For America to continue to lead the world in science and technology innovation, it must have the most knowledgeable and skilled science, technology, engineering, and mathematics (STEM) workers in the world. The National Innovation Strategy includes programs that support scientists and engineers at the beginning of their careers, prepare the next generation of Americans to understand and meet environmental challenges, and educate the next generation with 21st century knowledge and skills while creating a world-class workforce.

Administration Priority Programs

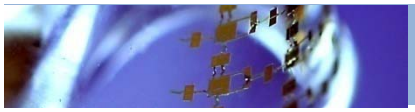
The FY 2011 budget maintains strong levels of support for four key Administration priority programs which were strongly supported in the FY 2010 Budget Request. The Graduate Research Fellowship (GRF) Program and the Faculty Early Career Development Program (CAREER) support the most promising students and early-career researchers in order to cultivate the next generation of STEM knowledge workers. Climate Change Education targets learning at all levels and is designed to develop the next generation of skilled, educated, and climate-savvy Americans. Advanced Technological Education supports new and enhanced two-year college programs that educate technicians for the high-technology workforce.

- **The Graduate Research Fellowship (GRF)** program supports the development of the Nation's future scientists and engineers. FY 2009 marked the beginning of a growth trajectory to triple the number of new awards made each year to 3,000 by FY 2013.
- **The Faculty Early Career Development Program (CAREER)** develops the future scientific and technical workforce through support of young faculty who are dedicated to integrating the excitement of research with inspired teaching and enthusiastic learning. Growing this program at the same rate as the overall agency budget is an Administration priority.
- **Climate Change Education** is designed to develop the next generation of skilled, educated, and climate-savvy Americans. It catalyzes activity at the national level in four strands of STEM education: preparation of a climate science professional workforce; public understanding and engagement; resources for learning; and local and national STEM education policy.
- **Advanced Technological Education** supports new and enhanced two-year college programs that educate technicians for the high-technology workforce. It is on a growth trajectory begun in FY 2010 to increase the program's funding to $100 million by FY 2013.

FY 2011 Administration Priority Programs

(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	Change over FY 2010 Estimate	
					Amount	Percent
Graduate Research Fellowship Program	$115.49	$46.94	$135.92	$158.24	$22.32	16.4%
Faculty Early Career Development	186.55	166.20	196.39	209.16	12.77	6.5%
Climate Change Education Program	9.95	-	10.00	10.00	-	-
Advanced Technological Education	51.85	-	64.00	64.00	-	-



Learning and Broadening Participation

"…Expand opportunities for all our young people, including women and minorities who too often have been underrepresented in scientific and technological fields, but who are no less capable of succeeding in math and science and pursuing careers that will help improve our lives and grow our economy."
–President Obama, November 23, 2009

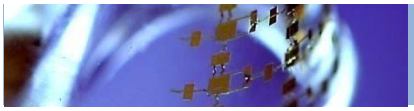
Broadening Participation (3 percent increase to $788.2 million). The FY 2011 Budget maintains strong support for agency-wide efforts to bring a fuller array of perspectives and participants to advancing discovery and innovation. Investments across NSF seek to broaden participation among people, institutions, and geographical regions.

Comprehensive Broadening Participation of Undergraduates in STEM, ($103.1 million). With an FY 2011 investment of $103.1 million, NSF will implement a new consolidated program, which will realign and build on existing programs and activities: Historically Black Colleges and Universities Undergraduates Program, Louis Stokes Alliances for Minority Participation, Tribal Colleges and Universities Program, and NSF's support for Hispanic-serving institutions. This new program's objective is to break down programmatic stovepipes in order to build sustainable partnerships and alliances among institutions with strong track records in producing underrepresented science, technology, engineering, and mathematics (STEM) graduates, thereby building capacity for the STEM field across a range of institutions. These comprehensive partnerships will increase the institutions' competitiveness by:

- strengthening STEM curricular offerings, enhancing STEM faculty development, and increasing competencies and competitiveness of students;
- transforming infrastructure, operations, and resources;
- increasing support for and engagement in frontier scientific research and access to advanced research instrumentation, and maximizing undergraduate research opportunities;
- facilitating expanded collaboration between scientists and educators at minority-serving institutions with those at majority institutions; and
- stimulating innovation and creativity from the nation's education and research enterprise through support of effective collaborations between minority–serving and majority institutions, especially research-intensive universities with NSF Science and Technology Centers, Materials Research Science and Engineering Centers, and Engineering Research Centers.

Experimental Program to Stimulate Competitive Research (EPSCoR), (5 percent increase to $154.4 million) EPSCoR stimulates sustainable improvements in research participation from institutions in geographical areas that are underrepresented in NSF activities. Strategies include supporting research infrastructure improvement, co-funding disciplinary and interdisciplinary research, and conducting outreach and workshops.

Government-wide Strategy for STEM Education. In addition to its support for the programs and priorities already mentioned, NSF is actively engaged as a leading participant in the coordinated, government-wide strategy for STEM education. NSF is poised to build on previous and emerging collaborations with the U.S. Department of Education, and to use NSF's unique experience and knowledge base in STEM education to identify research and evaluation priorities and to consider appropriate standards of evidence for various stages of research and development cycles. The agencies are embarking jointly on possible collaborations and complementary initiatives to help states improve K-12 student learning in STEM by building and sharing knowledge of effective curricular and instructional practices, and how they can be implemented at scale.



Investment Portfolios

A portfolio investment strategy specifically addresses our role in addressing national challenges, such as stimulation of economic growth, promotion of innovative energy technologies which can help mitigate the impact of climate change, training of a world-class STEM workforce, and nurturing a scientifically literate population.

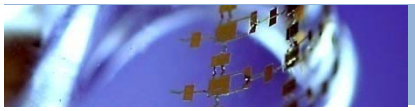
A wide range of ongoing NSF investments contribute directly to energy technologies, understanding and mitigating climate change, and promoting green jobs. The FY 2011 Request presents a new framework for coordinating and enhancing these investments. To leverage NSF's strengths towards addressing the challenges we face, NSF proposes to focus on the full portfolio of activities in two key areas of national importance.

Science, Engineering, and Education for Sustainability (SEES), (16 percent increase to $765.5 million) will integrate NSF's efforts in climate and energy science and engineering to generate the discoveries and capabilities needed to inform societal actions that lead to environmental and economic sustainability. SEES addresses recommendations from the August 2009 report from the National Science Board, *Building A Sustainable Energy Future*, which emphasized systems approaches to research programs, education and workforce development, public awareness and outreach, and the importance of partnerships with other agencies, states, universities, industry, and international organizations.

Cyberlearning Transforming Education (CTE), (63 percent increase to $41.3 million). This new multidisciplinary research program is intended to fully capture the transformative potential of advanced learning technologies across the education enterprise. CTE will enable wholly new avenues of science, technology, engineering, and mathematics (STEM) learning for students and for workforce development. Collaborating with the Department of Education to bring advances in technology to learners at all educational levels will advance the Nation's ability to study the learning process itself.

FY 2011 Investment Portfolios
(Dollars in Millions)

	FY 2010 Estimate	FY 2011 Request	Change over FY 2010 Estimate Amount	Change over FY 2010 Estimate Percent
Science, Engineering and Education for Sustainability (SEES)	$660.74	$765.50	$104.76	15.9%
Cyberlearning Transforming Education (CTE)	25.33	41.28	15.95	63.0%



Interagency Activities

As the leading federal agency funding basic research, all directorates and offices within NSF participate in a number of interagency partnerships and collaborations coordinated by the National Science and Technology Council (NSTC). NSF adds value to these activities through its support of basic research that covers all fields of science and engineering. NSF's support for such fundamental research provides a sound basis for decisions and policies by federal, state, regional, and local authorities, and participation in this research trains the next generation of scientists and engineers in the problems of the future.

U.S. Global Change Research Program (USGCRP), (16 percent increase to $369.9 million). The USGCRP engages thirteen U.S. agencies in a concerted program of basic research, comprehensive observations, integrative modeling, and development of products for decision-makers. Primary FY 2011 research foci are climate variability and change across temporal and spatial scales, study of terrestrial and marine ecosystems, human contributions and responses to climate change, and the general processes used by organizations to identify and evaluate policies for mitigation, adaptation, and other responses to varying environmental conditions.

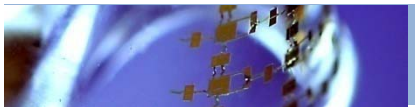
Networking and Information Technology Research and Development (NITRD), (7 percent increase to $1.170 billion). NITRD coordinates the unclassified networking and information technology research and development investments across thirteen federal agencies. These agencies work together to develop a broad spectrum of advanced networking and IT capabilities to power federal missions, economic competitiveness, and science, engineering, and technology leadership. NSF is a leader in the program and NITRD activities represent 16 percent of NSF's FY 2011 budget. Funding foci for FY 2011 include large scale networking, cybersecurity and information assurance, high confidence software and systems, human-computer interaction and information management, and software design and productivity.

National Nanotechnology Initiative (NNI), (4 percent decrease to $401.3 million). NSF's NNI program is coordinated with 25 departments and agencies across the federal government. NNI encompasses the systematic understanding, organization, manipulation, and control of matter at the atomic, molecular, and supramolecular levels in the size range of 1 to 100 nanometers. NSF's investment in this activity increases in two key areas in FY 2011: nanomanufacturing (44 percent increase to $32.2 million) and Environmental, Health and Safety (11 percent increase to $33.0 million).

Homeland Security Activities, (4 percent increase to $405.4 million). NSF funds homeland security by funding research in two general areas: protecting critical infrastructure and key assets and defending against catastrophic threats. 75 percent of these funds are applied towards research in cybersecurity, emergency planning and response, and risk management, modeling, and simulation of resilient infrastructure.

FY 2011 Interagency Activities
(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	Change over FY 2010 Estimate Amount	Change over FY 2010 Estimate Percent
U.S. Global Change Research Program	$269.26	$120.54	$319.06	$369.91	$50.85	15.9%
Networking and Information Technology R & D	1,011.62	347.16	1,090.48	1,170.07	79.59	7.3%
National Nanotechnology Initiative	408.62	101.20	417.69	401.25	-16.44	-3.9%
Homeland Security Activities	378.40	43.08	390.03	405.43	15.40	3.9%



Major Research Equipment and Facilities Construction

NSF exercises stewardship of the Nation's research infrastructure through its investments in Major Research Equipment and Facilities Construction (MREFC). By constructing major research facilities, platforms, and networks, NSF seeks to advance the frontiers of science and engineering, enable the training of a world-class workforce, and provide equipment and services to industry partners.

In FY 2011, NSF plans to initiate construction of the **National Ecological Observatory Network (NEON)**. NEON is designed to detect and enable forecasting of ecological change at the continental scale over multiple decades. It will collect data on the impacts of climate change, land use changes, and invasive species on natural resources and biodiversity. NEON data will contribute to multi-scale models of global change that will support local, regional, national, and global analyses of potential scenarios for adapting to and mitigating climate change.

In addition, NSF continues its support of four ongoing construction projects:

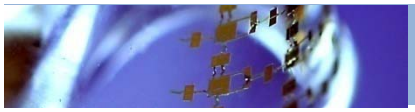
- **Advanced Laser Interferometer Gravitational-Wave Observatory (AdvLIGO).** A planned upgrade of the existing Laser Interferometer Gravitational-Wave Observatory (LIGO), AdvLIGO will be ten times more sensitive, powerful enough to approach the ground-based limit of gravitational-wave detection.
- **Advanced Technology Solar Telescope (ATST).** ATST will enable study of the Sun's magnetic fields, which is crucial to our understanding of the types of solar variability and activity that affects Earth's civil life and may impact its climate.
- **Atacama Large Millimeter Array (ALMA).** ALMA will provide a testing ground for theories of planet formation, star birth and stellar evolution, galaxy formation and evolution, and the evolution of the universe itself.
- **Ocean Observatories Initiatives (OOI).** OOI will enable continuous, interactive access to the ocean via multiple types of sensors linked by cutting-edge cyberinfrastructure, which will produce never-before-seen views of the ocean's depths.

MREFC Account Funding, by Project

(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request
Advanced Laser-Inferometer Gravity-wave Observatory (AdvLIGO)	$51.43	-	$46.30	$23.58
Advanced Technology Solar Telescope (ATST)	-	-	13.00	17.00
Alaska Region Research Vessel (ARRV)	14.13	148.07	-	-
Atacama Large Millimeter Array (ALMA)	82.25	-	42.76	13.91
IceCube Neutrino Observatory	11.85	-	0.95	-
National Ecological Observatory Network (NEON)	-	-	-	20.00
Ocean Observatories Initiative (OOI)	-	105.93	14.28	90.70
South Pole Station Modernization (SPSM)	1.10	-	-	-
Total, MREFC	**$160.76**	**$254.00**	**$117.29**	**$165.19**

Totals may not add due to rounding.



Stewardship, Evaluation, and Performance

Since 2001, the number of proposals submitted to NSF has increased by over 50 percent. In that time, staffing has increased by only 19 percent. To support NSF's excellence in science and engineering research and education, NSF must invest in expanding and developing its workforce and resources to maintain a capable and responsive organization.

Stewardship

The FY 2011 Request includes $468.8 million (+$39.1 million) for activities aimed at assuring that NSF will be able to effectively and efficiently manage its operations. Funds will support:

- **Staff,** 40 additional full-time equivalents (for a total of 1,350 FTE) and eleven additional IPAs are requested;
- **IT investments,** such as the expansion of Research.gov, modernization of the NSF financial system, and improvements in the reliability and security of NSF's operational IT systems; and
- **Acquisition,** ($2.0 million). This increase is part of the government-wide effort to strengthen the acquisition workforce. A key priority for NSF is improving capabilities in the pre-solicitation phase of major acquisitions.

Evaluation and Performance

NSF is committed to promoting strong, independent evaluation that can inform its policy decisions, program management, and performance. NSF participates in the Administration's government-wide initiative to strengthen program evaluation and performance measurement, and shares its commitment to post the status and findings of this and other important publicly available evaluations online.

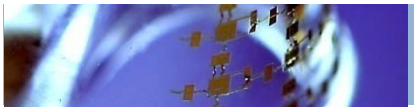
- **High-Priority Performance Goal:** NSF's goal for the end of FY 2011 is to develop evaluation and assessment systems for STEM education and workforce programs that can provide findings leading to program re-design or consolidation.
- **Foundation-wide planning, analysis, and evaluation.** $1.0 million will support additional staff and associated resources for the establishment of a centralized NSF capability for assessment and evaluation. This would bring greater attention and analysis to such areas as comparing different types of programmatic investments and identifying the most effective means for continuous improvement across the NSF portfolio.

Stewardship by Appropriations Account

(Dollars in Millions)

	FY 2009 Omnibus Actual	FY 2009 ARRA Actual	FY 2010 Estimate	FY 2011 Request	Change over FY 2010 Estimate Amount	Change over FY 2010 Estimate Percent
Agency Operations and Award Management	$294.09	-	$300.00	$329.19	$29.19	9.7%
Office of Inspector General	11.99	0.02	14.00	14.35	0.35	2.5%
National Science Board	4.02	-	4.54	4.84	0.30	6.6%
Research & Related Activities	88.25	-	96.47	104.32	7.85	8.1%
Education and Human Resources	13.08	-	14.74	16.12	1.38	9.4%
Subtotal, Program Support	101.34	-	111.21	120.44	9.23	8.3%
Total, Stewardship	**$411.44**	**$0.02**	**$429.75**	**$468.82**	**$39.07**	**9.1%**

Totals may not add due to rounding.



American Recovery and Reinvestment Act

A primary purpose of the American Recovery and Reinvestment Act of 2009 is to "increase economic efficiency by spurring technological advances in science and health." NSF's role in stimulating the American economy was acknowledged by its inclusion in the Act. In FY 2009, NSF's investments created and sustained research jobs; addressed the national need to increase the pool of qualified K-12 STEM teachers; and met facilities and infrastructure needs, including deferred maintenance.

NSF obligated $2.4 billion (80 percent) of its total ARRA funding in FY 2009. As a direct consequence of ARRA funding, NSF was able to:

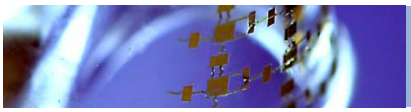
- Increase its funding rate to 32 percent in FY 2009, the highest since FY 2000;
- Fund 318 proposals (7 percent) that had been declined earlier in the year due to budgetary constraints even though they were rated very good to excellent;
- Increase the number of CAREER and GRF awardees;
- Increase funding for new principal investigators and co-investigators;
- Significantly boost its investment in climate and energy research;
- Reinvest in facilities where maintenance and improvements had been deferred or staff had been reduced; and
- Support projects in all 50 states, the District of Columbia, and Puerto Rico.

FY 2009 ARRA Results

Program/Activity	Funds Received ($ millions)	Funds Obligated ($ millions)	Measure	Result
Research & Related Activities (R&RA)	$2,500	$2,063	Number of competitive awards *(target: 4,000)*	4,599
			Number of investigators supported on competitive awards *(target: 6,400)*	6,762
			Number of new investigators supported on competitive awards *(target: 2,400)* [1]	2,352
Education & Human Resources (EHR)	$100	$85	Number of awards *(target: 76)*	76
Major Research Equipment and Facilities Construction (MREFC)	$400	$254	Number of awards	2
TOTAL	**$3,000**	**$2,402** *(80%)*		**4,677**

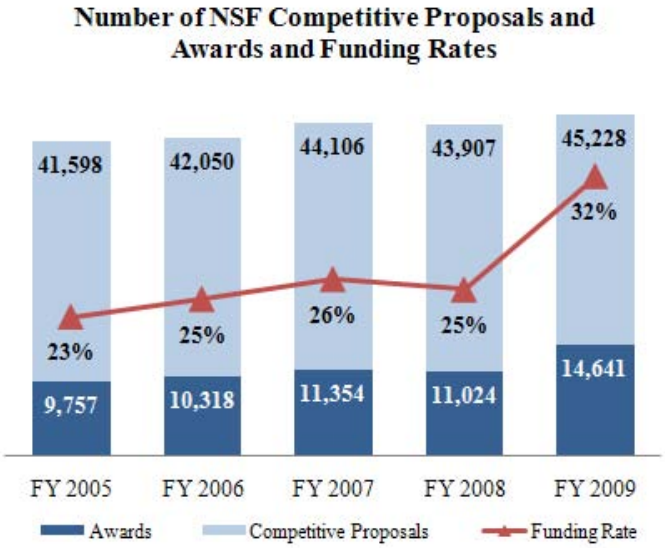
[1] This goal set a target that exceeded the baseline level (FY 2008) by roughly 20 percent. The level reached (2,352 new investigators) fell 2 percent short of this ambitious target. See the Performance chapter for further discussion.

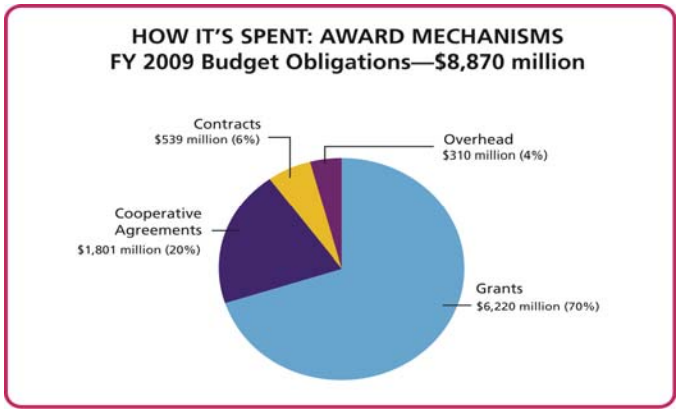
NOTE: The Office of Inspector General received $2.0 million for oversight activities.



NSF by the Numbers

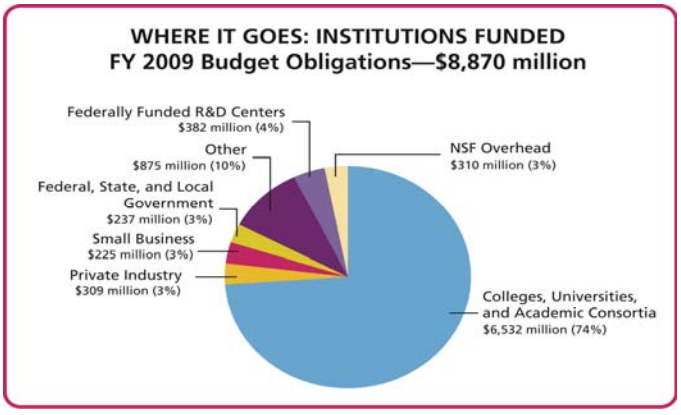
In FY 2009, NSF evaluated 45,228 proposals and made 14,641 new awards, of which 4,677 were funded by the American Recovery and Reinvestment Act (ARRA). ARRA boosted NSF's FY 2009 funding rate to 32 percent, the highest since FY 2000. Nearly 239,000 proposal reviews were conducted, involving almost 46,000 external reviewers. NSF awards were made to 1,967 colleges, universities, and other public and private institutions in 50 states, the District of Columbia, and Puerto Rico. NSF supports approximately 241,000 researchers, postdoctoral fellows, trainees, teachers, and students.

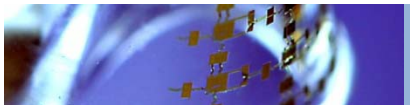




90 percent of NSF's FY 2009 projects were funded using grants or cooperative agreements. Grants can be funded either as standard awards in which funding for the full duration of the project is provided in a single fiscal year, or as continuing awards, in which funding for a multi-year project is provided in increments. Cooperative agreements are used when the project requires substantial agency involvement during the project performance period (e.g., research centers, multi-user facilities, etc.). Contracts are used to acquire products, services, and studies (e.g., program evaluations) required primarily for NSF or other government use.

Most NSF awards are to academic institutions. Nonprofit organizations include state and local governments and international organizations. For-profit businesses include private and small businesses. Federal agencies and laboratories include funding for Federally Funded R&D Centers.





Highlights

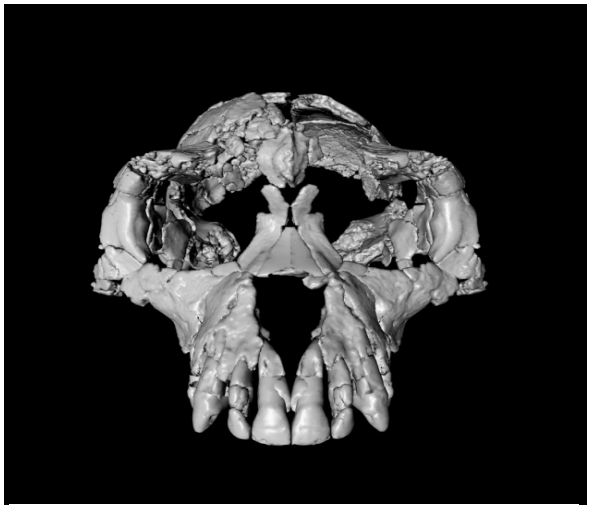


Image Credit: © 2009 Tim White and Gen Suwa, rendered by Primary Pictures.

Science's Breakthrough of the Year: Researchers Discover a New Hominin, *Ardi*

In a large scientific collaborative effort, scientists discovered a female skeleton, *Ardipithecus ramidus*. Nicknamed *Ardi*, the female skeleton is 4.4 million years old, 1.2 million years older than "Lucy", the fossil previously recognized as the earliest hominid skeleton ever found. *Ardi* represents a new kind of hominin, the family that includes humans and our ancestors, but does not include ancestors of other living apes. *Ardi's* anatomy is unusual and is not similar to living apes or later hominins including *Lucy*. Her bones indicate that she walked upright while still living in the woodland suggesting that our ancestors started walking upright on branches. The discovery of *Ardi* was named the Breakthrough of the Year by the journal *Science*.

Kraken: One of the Fastest Supercomputers

The supercomputer Kraken, the Cray XT5 supercomputer at the National Institute for Computational Sciences at the University of Tennessee, was rated as one of the world's fastest supercomputers--one of only four computers in existence that can perform more than 1,000 trillion calculations per second, known as a petaflop. Kraken was used to simulate a 7.8 magnitude earthquake in Southern California. This simulation produced hazard maps that illustrated where the ground was most sensitive to movement. The simulation results were incorporated into building codes, preparing future structures for a big earthquake and saving lives and dollars when the next earthquake hits.

Image Credit: © 2010 Jupiter Images Corporation

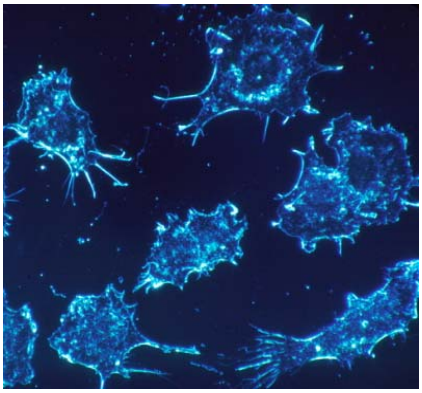
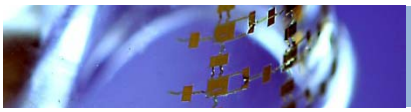


Image Credit: Dr. Cecil Fox, NCI.

Cancer Tumors Impact Surrounding Cells

A new study by Northwestern University researchers of human colon, pancreatic and lung cells is the first to report that cancer cells and their non-cancerous cell neighbors, although quite different under the microscope, share very similar structural abnormalities on the nanoscale level. This finding confirms the "field effect", a phenomenon where cells located a distance away from a malignant or premalignant tumor undergo molecular and other abnormal changes. Moreover, the researchers found that the same abnormalities found in the nanoarchitecture of the colon cells were also found in both the pancreas and lung, suggesting a commonality across three different organs.



Highlights

Stomach Bacteria Alters Its Environment

A team of researchers from Boston University, Harvard Medical School and the Massachusetts Institute of Technology showed that *Helicobacter pylori*–the bacterium that inhabits various areas of the stomach where it causes chronic, low-level inflammation and is linked to gastric ulcers and stomach–uses a clever biochemical strategy to alter the physical properties of its environment, allowing it to move and survive and further colonize its host. In order to colonize the stomach, *H. pylori* must cope with highly acidic conditions in which other bacteria are unable to survive. It has been known that *H. pylori* survives by producing ammonia to neutralize the acid, but this research demonstrates for the first time that *H. pylori* also changes its environment to enable freer movement by increasing the pH of its surroundings and changing a protein in the layer of the stomach to a liquid, allowing it to swim across the mucus barrier, establish colonies, attack surface cells, and form ulcers.

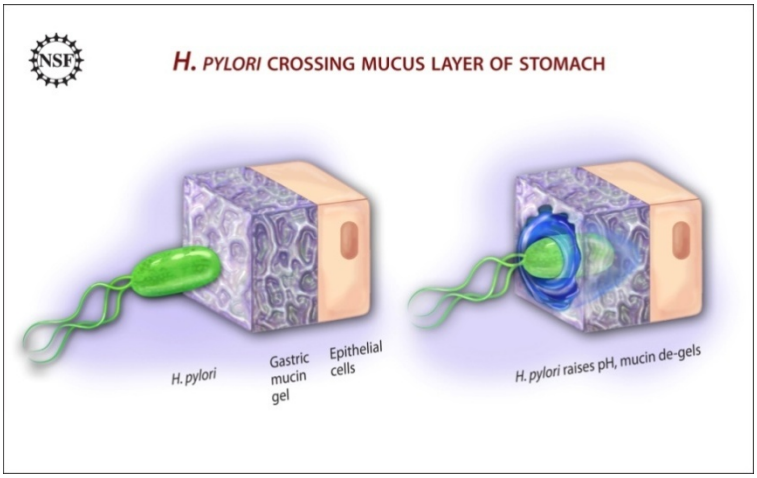


Image Credit: *Zina Deretsky, National Science Foundation.*

Discovery of a New Super-Earth

Astronomer David Charbonneau from Harvard University and his research team discovered a "super-Earth" planet orbiting a red dwarf star only 40 light-years from Earth, using a small fleet of ground-based telescopes. A super-Earth is a planet between one and ten times the mass of the Earth. This planet is 6.5 times the size of the Earth, has a temperature of 400 degrees Fahrenheit, and orbits a small, red type M star about one-fifth the size of the Sun. Despite its extreme temperature, this new super-Earth is a waterworld and is more Earthlike than any previously discovered exoplanet. This new super-Earth could be the first one confirmed to have an atmosphere, although that atmosphere probably would not be hospitable to life as we know it. Since the planet is only 40 light-years from Earth, the research team is planning to use NASA's Hubble Space Telescope to detect and determine the content of the atmosphere.

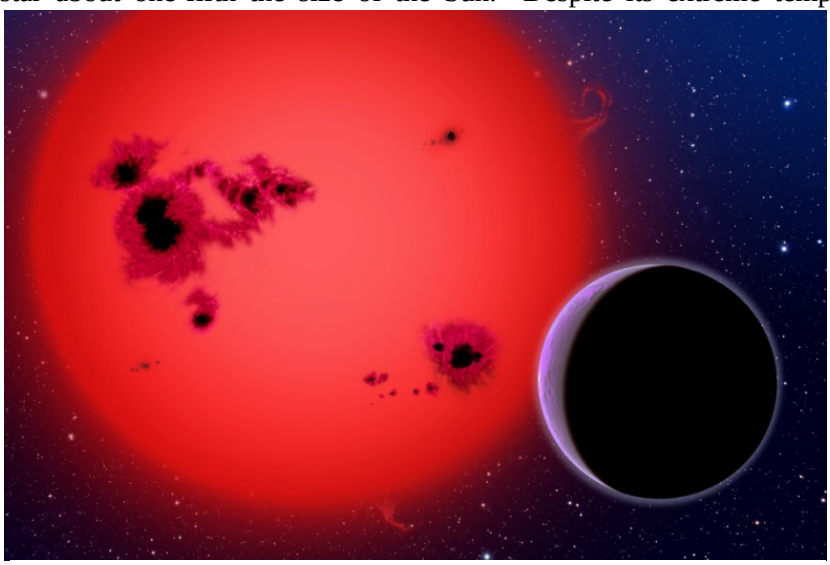
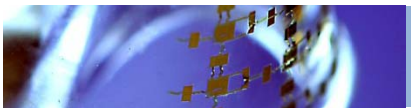


Image Credit: *David Aguilar, Harvard-Smithsonian CfA.*



Highlights

Discovery of a New Meat-eating Dinosaur, *Tawa halla*

A research team led by Sterling Nesbitt of the University of Texas at Austin unearthed a previously unknown meat-eating dinosaur, *Tawa halla*, in New Mexico. The discovery of *Tawa* sheds light on dinosaur evolution and helps unite all Triassic carnivorous dinosaurs into one group, the theropods, which is the same group that included *Tyrannosaurus rex* and now includes modern birds. This discovery supports the hypothesis that dinosaurs originated in present day South America and then diverged into theropods, sauropodomorphs (the group that includes ground-shaking giants like *Apatosaurus*) and ornithischians (the group that includes *Stegosaurus* and *Triceratops).*

Image Credit: Jorge Gonzalez.

Improved Diagnostic Test for Sleep Apnea

A computer scientist from the University of Houston and a doctor of sleep medicine at the University of Texas Health Science Center at Houston teamed up to create a new, less invasive method of diagnosing sleep apnea. Sleep apnea is a serious disorder that causes people to momentarily stop breathing while they sleep, sometimes hundreds of times a night. Sleep apnea is associated with serious health problems including depression, heart disease and stroke. The new procedure developed by the research team to diagnose sleep apnea uses a thermal infrared camera to monitor breathing and airflow as the person breathes in and out of their nose. This new diagnostic procedure is less invasive and provides doctors with more information about the patient's breathing.

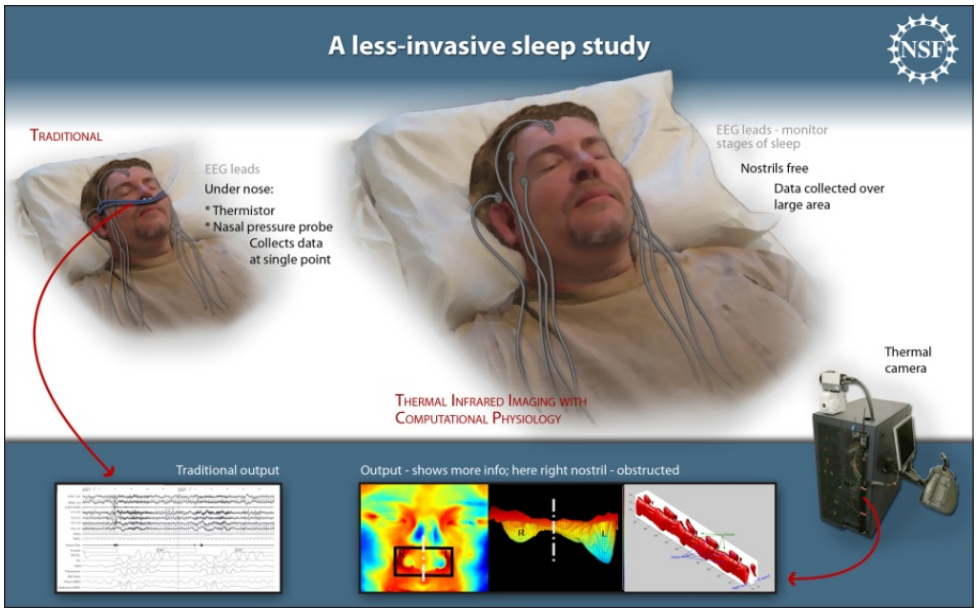
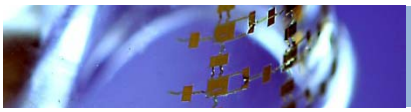


Image Credi: Zina Deretsky, National Science Foundation.



Highlights

Teachers in the Lab Lead to Higher Student Test Scores

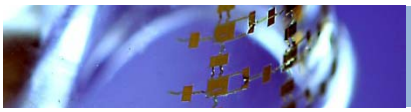
Image Credit: Summer Research Program for Science Teachers, Columbia University.

Samuel Silverstein and his colleagues at Columbia University found that research experiences for science teachers can have a direct impact on the achievement of their students, significantly increasing student performance on state assessment tests. Silverstein is the founder and director of Columbia University's Summer Research Program for Secondary School Science Teachers (CUSRP), a program that gives middle and high school science teachers from New York City an opportunity to work on research projects at Columbia University. Silverstein found that students of teachers who had participated in CUSRP for more than two years scored 10 percentage points higher on the New York State's Science Regents examinations as compared to students whose teachers had not participated in CUSRP.

Deepest Erupting Volcano Recorded

Scientists have recorded in high definition video the deepest erupting volcano yet discovered. The West Mata Volcano is nearly 4,000 feet below the surface of the Pacific Ocean, in an area bounded by Fiji, Tonga and Samoa. The volcano was recorded by an underwater robot and eruption sounds were recorded by a hydrophone. The West Mata Volcano produced boninite lavas, a type of lava seen before only on extinct volcanoes more than a million years old, and the hottest on Earth today. The video captured glowing red vents exploding lava into the sea, and was the first time that researchers had observed molten lava flowing across the deep-ocean seafloor.

Image Credit: *NSF/NOAA.*



Mountain Range Discovered Under the East Antarctic Ice Sheet

A U.S.-led, international research team confirmed the existence of an Alps-like mountain range under the East Antarctic Ice Sheet and created a detailed picture of the rugged landscape buried under more than four kilometers (2.5 miles) of ice. Working in some of the harshest conditions with temperatures averaging -30 degrees Celsius (-22 degrees Fahrenheit), the team flew twin-engine light aircraft the equivalent of several trips around the globe and established a network of seismic instruments across an area the size of Texas. This large mountain range under the ice is likely to have caused the massive East Antarctic Ice Sheet, which extends over more than 10 million square kilometers atop the bedrock of Antarctica, to form. The mountain range has peaks and valleys, similar to the European Alps, and it is likely the ice sheet formed quickly, not slowly, as previously thought.

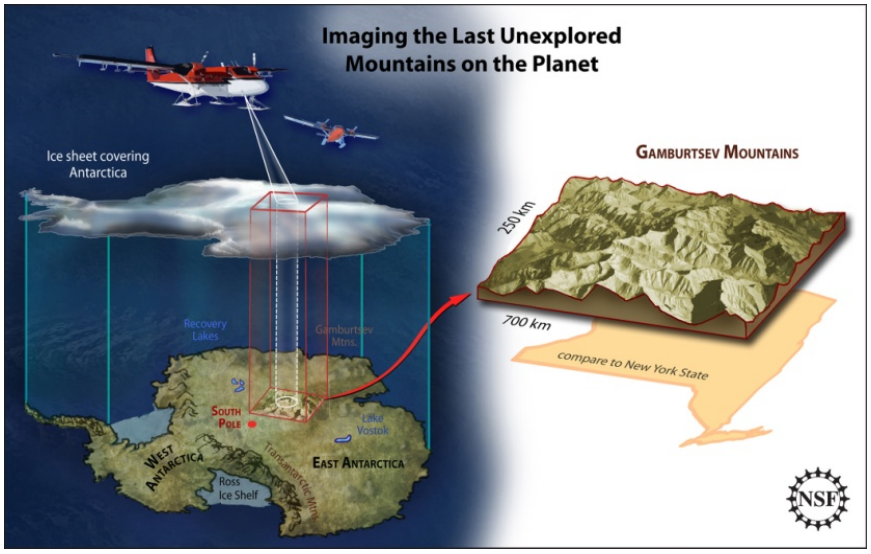


Image Credit: *Zina Deretsky, National Science Foundation.*

Chicxulub Crater May Not Be Responsible Dinosaur Extinction

A research team, led by Gerta Keller of Princeton University and Thierry Adatte of the University of Lausanne, Switzerland, has challenged the popular theory that an asteroid collision led to the demise of dinosaurs and other species some 65 million years ago. The theory is that the Chicxulub crater, discovered in 1978 in northern Yucatan and measuring about 180 kilometers (112 miles) in diameter, records a massive extra-terrestrial impact that caused the demise of the dinosaurs along with many animal and plant species. The latest research by Keller and Adatte uses evidence from Mexico to suggest that the Chicxulub impact predates the Cretaceous-Tertiary (K-T) boundary by as much as 300,000 years. The researchers found the same level of species diversity in fossils present below and above the impact layer, indicating that the Chicxulub impact did not have a dramatic impact on species diversity. Their research suggests that the Chicxulub impact and the mass extinction at the end of the Cretaceous period may not be linked. Instead, Keller proposes that the massive volcanic eruptions at the Deccan Traps in India may be responsible for the extinction.

Image Credit: *NASA.*