NSF FY 2012 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.***

*The National Science Foundation Strategic Plan for FY 2011 – 2016, "Empowering the Nation Through Discovery and Innovation", defines our vision: "****a nation that capitalizes on new concepts in science and engineering and provides global leadership in advancing research and education."***

For 60 years the National Science Foundation (NSF) has played a central role in innovation by catalyzing the development of fundamental ideas in science and engineering and supporting the people who generate them. As the only federal agency dedicated to the support of basic research and education across all fields of science and engineering, and in a time when economic and environmental challenges are becoming increasingly pressing, NSF is positioned to strategically stimulate innovative research that connects the science and engineering enterprise with potential economic, societal, and educational benefit. NSF's high-risk, potentially transformative investments will continue to lead the way for the important discoveries and cutting-edge technologies that will help keep our Nation globally competitive, prosperous, and secure.

NSF's FY 2012 Budget Request is $7.767 billion, an increase of $894.49 million (13 percent) over the 2010 Enacted level. In addition, NSF will receive $1.0 billion over five years for research on improving access to wireless broadband through the Wireless Innovation (WIN) Fund proposed under the Administration's Wireless Innovation and Infrastructure Initiative (WI3).

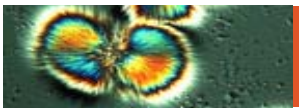
NSF Funding by Account
(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR[2]	FY 2012 Request	Change Over FY 2010 Enacted Amount	Percent
Research & Related Activities[1]	$5,615.33	$439.17	$5,563.92	$6,253.54	$689.62	12.4%
Education & Human Resources	872.77	15.00	872.76	911.20	38.44	4.4%
Major Research Equipment & Facilities Construction	165.90	146.00	117.29	224.68	107.39	91.6%
Agency Operations & Award Management	299.85	-	300.00	357.74	57.74	19.2%
National Science Board	4.38	-	4.54	4.84	0.30	6.6%
Office of Inspector General	13.97	0.05	14.00	15.00	1.00	7.1%
Total, NSF	**$6,972.20**	**$600.22**	**$6,872.51**	**$7,767.00**	**$894.49**	**13.0%**

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.

[2] A full-year 2011 appropriation was not enacted at the time the budget was prepared; therefore, NSF is operating under a continuing resolution (P.L. 111–242, as amended). The amounts included for 2011 reflect the annualized level by account provided by the continuing resolution.



NSF: The Innovation Agency

The NSF Strategic Plan for FY 2011-FY 2016, "Empowering the Nation Through Discovery and Innovation," [1] builds on lessons learned from past accomplishments and provides a clear map for future successes by refining NSF's vision statement and strategic goals to align with both Administration and agency priorities. The plan establishes an overarching vision for NSF's role in the Nation's innovation enterprise: "a nation that capitalizes on new concepts in science and engineering and provides global leadership in advancing research and education." The plan outlines three major goals for NSF:

- **"Transform the Frontiers"** embraces NSF's unique role in supporting fundamental, interdisciplinary, high-risk, and transformative research and education, including building human capacity through educating tomorrow's science, technology, engineering, and mathematics (STEM) workforce;
- **"Innovate for Society"** focuses on linking the results of fundamental research to national and global policy areas where science and engineering play a significant role and on engaging the STEM workforce and the Nation overall in addressing pressing national challenges; and
- **"Perform as a Model Organization"** sets high standards for attaining excellence in operational activities, promotes a culture of integrity and accountability, and encourages new approaches to assessment and evaluation of NSF's investment portfolio.

NSF: The Innovation Agency. To fuel the innovations of the future, NSF continues 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 key basic research agencies. NSF's FY 2012 Budget Request to Congress is consistent with this plan.

NSF is committed to both maintaining and growing its basic research core and enabling the emergence of transformational work, new fields, and new theoretical paradigms, particularly through multidisciplinary and agency-wide mechanisms that reflect the increasingly interdisciplinary nature of modern science and engineering. The FY 2012 Budget Request demonstrates how the innovative programs, portfolios, and initiatives created and cultivated within the Foundation align with the Administration's *Strategy for American Innovation.*

Invest in the Building Blocks of American Innovation: New interdisciplinary partnerships within NSF will produce new ways of thinking and solving problems, and educational programs to train the STEM workforce will build the human capacity necessary for tomorrow's innovations. NSF is already poised to assume leadership in orchestrating responses to problems posed in new decadal surveys and key national reports, including challenges raised in the recent President's Council of Advisors on Science and Technology (PCAST) *Prepare and Inspire* report on K-12 STEM education, and the *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5* report by the same committee that authored the seminal 2005 report. FY 2012 highlights include:

- **Growth in Research Grants** The FY 2012 Request supports approximately 2,000 additional research grants over the FY 2010 Enacted level, for a 27.8 percent increase.

[1] This plan was completed before the enactment of the GPRA Modernization Act of 2010. NSF therefore expects to have an updated plan in FY 2013 to address the requirements in the new legislation.

- **Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)** ($12.35 million), a new effort for FY 2012, will catalyze interdisciplinary research by seamlessly integrating a suite of new activities with existing efforts and other NSF investments so as to foster and support transformative research through interdisciplinary research (IDR) proposals. INSPIRE awards will support senior and junior single investigators, as well as small groups of researchers, to enable innovative and transformative IDR breakthroughs.
- **Science and Engineering Beyond Moore's Law (SEBML)** ($96.18 million) is a multidisciplinary research investment that aims to surpass the physical and conceptual limits that will halt computer processing development within the next 10 to 20 years. SEBML supports new scientific, mathematical, engineering, and conceptual frameworks, which are needed for computer hardware and architecture advances that will address challenges such as efficient input and output, data storage and communication, and reduction of energy consumption, as well as sheer computing power. SEBML research also enhances NSF investments in both the National Nanotechnology Initiative (NNI) and in Networking and Information Technology Research and Development (NITRD).
- **Research at the Interface of the Biological, Mathematical, and Physical Sciences (BioMaPS)** ($76.14 million), is a collaboration among the Directorates for Biological Sciences, Engineering, and Mathematical and Physical Sciences that aims to result in accelerated understanding of biological systems, and then apply that knowledge into fundamental understanding and new technologies, particularly clean energy.
- **Science, Technology, Engineering, and Mathematics (STEM) Education programs** promote innovative research, development, and evaluation of learning and teaching across all ages and STEM disciplines. In FY 2012, new programs include:
  - **Teacher Learning For the Future (TLF)** ($20.0 million) focuses on the potential to improve the training of pre-service, in-service, and future generations of teachers as the structure of formal education changes and the boundaries of in-school and out-of-school learning blur;
  - **Widening Implementation and Demonstration of Evidence-based Reforms (WIDER)** ($20.0 million) aims to widely transform STEM education for undergraduates by supporting research on how to achieve widespread sustainable implementation of undergraduate instructional practices leading to improved student outcomes in STEM at major universities through demonstration models; and
  - **Transforming Broadening Participation through STEM (TBPS**) ($20.0 million), a new pilot program that will be launched in FY 2012. This new program will seek innovative solutions for broadening participation in STEM at the undergraduate level in anticipation of tomorrow's changing demographics, including increased engagement with Hispanic-serving institutions.
- **The Faculty Early Career Development program (CAREER)** ($221.96 million) 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. In FY 2012, NSF will support approximately 60 more CAREER awards than at the FY 2010 Enacted level, for a total of 606 new awards. The CAREER portfolio includes projects that range across all fields of science and engineering supported by the Foundation, including high priority fields such as clean energy, climate change, STEM education, and cybersecurity.
- **The Graduate Research Fellowship program (GRF)** ($198.14 million) supports the development of students and early-career researchers in order to cultivate the next generation of STEM workers. In FY 2012, 2,000 new fellowship offers will be made, maintaining the doubling of new fellowship awards achieved in FY 2010. In addition, the cost of education (COE) allowance will be increased from $10,500 to $12,000, the first increase in this level since 1998. NSF will also begin implementing a multi-year plan to address inflationary pressures on the long-stagnant GRF stipend level, including initial funding in FY 2012 for a stipend increase to $32,000 that will be fully implemented in FY 2013. Additional stipend increases are planned beyond FY 2013.

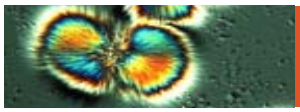
- **Community college funding** ($100.0 million) is a continued priority in FY 2012. As President Obama noted at the October 2010 White House Summit on Community Colleges, these institutions provide "a gateway to millions of Americans to good jobs and a better life." NSF plans to expand and strengthen efforts to engage community colleges through several core research and development programs, including Advanced Technological Education (ATE), Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics (TUES), the Louis Stokes Alliances for Minority Participation (LSAMP), and the Tribal Colleges and Universities Program (TCUP).

***Promote Competitive Markets that Spur Productive Entrepreneurship*:** Advances in technology, economic growth, and society depend upon the conversion of fundamental discoveries into new processes, practices, or new commercial products that are widely used. Many NSF activities incentivize scientists, engineers, and educators to undertake use-inspired research that translates and transforms basic discoveries into applications for the benefit of society and the economy. FY 2012 highlights include:

- **Advanced Manufacturing** ($190.40 million) holds tremendous potential for significant short-term and long-term economic impact by promising entirely new classes and families of products that were previously unattainable. In FY 2012, NSF's increased investment emphasizes several emerging opportunities including cyber–physical systems, advanced robotics research, scalable nanomanufacturing, sensor and model-based smart manufacturing, educational activities to support training the next generation of product designers and engineers, and industry-university cooperation.
- **The Wireless Innovation (WIN) Fund,** a component of the Administration's new Wireless Innovation and Infrastructure Initiative (WI3), will provide $1.0 billion to NSF over the next five years. WI3 proposes to reallocate a total of 500 megahertz of federal agency and commercial spectrum bands over the next ten years to increase the Nation's access to wireless broadband. NSF will support research on experimental wireless technology testbeds, more flexible and efficient use of the radio spectrum, and cyber-physical systems such as wireless sensor networks for smart buildings, roads, and bridges. WIN is to be funded through receipts generated through electromagnetic spectrum auctions. NSF's FY 2012 investments from the WIN are expected to total $150.0 million, and will be coordinated with a number of other agencies including the Defense Advanced Research Projects Agency and the National Institute of Standards and Technology.
- **Enhancing Access to the Radio Spectrum (EARS)** ($15.0 million), in addition to related research funded through the WIN, will support research into new and innovative ways to use the radio spectrum more efficiently so that more applications and services used by individuals and businesses can occupy the limited amount of available spectrum. While the first year of the EARS program will be run entirely by NSF, it is hoped that future years can involve inter-agency solicitations that draw upon additional expertise, interests, and funding from other federal agencies to insure that the program is meeting broad federal objectives, consistent with the mission of NSF.
- **Engineering Research Centers (ERCs) and Industry/University Cooperative Research Centers (I/UCRC)** ($96.15 million total) focus much of their basic research on problems with potential economic impact. By working closely with industry, these programs create enabling technologies for national needs, such as managing the electrical power system, improving manufacturing and biological processing, and supporting new healthcare information and telecommunications technologies. They also prepare students for innovation leadership in a globally competitive marketplace.
- **The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs** ($146.88 million total) support innovation research and build partnerships between the academic and industry sectors. They bolster 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 reflect national and societal priorities.

Catalyze Breakthroughs for National Priorities: In FY 2012, NSF will focus on key national priority areas, which require the expertise of physical, biological, and social scientists and engineers, as well as educators at all levels. NSF-catalyzed research includes investments in clean energy and the advancing fields of bio- and nanotechnology, areas that are poised for innovative breakthroughs. FY 2012 highlights include:

- **Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21)** ($117.0 million), a new portfolio in FY 2012, builds on NSF's long history of providing leadership for cyberinfrastructure and computational science for the U.S. academic science and engineering community. CIF21 will develop and deploy comprehensive, integrated, sustainable, and secure cyberinfrastructure (CI) to accelerate research and education and new functional capabilities in computational and data-intensive science and engineering, thereby transforming our ability to effectively address and solve the many complex problems facing science and society.
- **The Science, Engineering, and Education for Sustainability (SEES) portfolio** ($998.19 million) consists of programs that spark innovations for tomorrow's clean energy solutions with a cross-disciplinary approach to sustainability science. SEES is designed to foster innovative insights about the environment-energy-economy nexus that will increase the effectiveness of our energy and management policies in adapting to and mitigating the impacts of climate change and improve our capabilities for rapid response to extreme events. SEES foci for FY 2012 include mechanisms for both research and education in sustainability, including research on Sustainable Energy Pathways (SEP), a formal program of Postdoctoral Fellowships in Sustainable Solutions, and targeted awards in the Partnerships for International Research and Education (PIRE) program.
- **Clean Energy investments** ($576 million) that will lead to future clean energy and energy efficiency technologies are seen throughout the NSF portfolio, in core research programs and activities such as BioMaPS and SEES. In addition, NSF participates in the Climate Change Technology Program (CCTP), an interagency activity with significant focus on clean energy research.
- **The National Nanotechnology Signature Initiatives** ($117.40 million) have the potential to both impact downstream applications that promise widespread economic benefit and improve national and homeland security. In FY 2012, NSF will participate in Nanotechnology for Solar Energy Collection and Conversion, Sustainable Nanomanufacturing – Creating the Industries of the Future, and Nanoelectronics for 2020 and Beyond. Through these, NSF also creates a significant investment in advanced manufacturing.
- **National Robotics Initiative (NRI)** ($30.0 million) is a new interagency initiative for FY 2012 that partners NSF with the National Aeronautics and Space Administration, National Institutes of Health, and the U.S. Department of Agriculture. NRI is a concerted program to provide U.S. leadership in science and engineering research and education aimed at the development of next generation robotics, conceived as robots that work beside, or cooperatively, with people in areas such as manufacturing, space and undersea exploration, healthcare and rehabilitation, military and homeland surveillance and security, education and training, and safe driving.



Interagency Activities

U.S. Global Change Research Program (USGCRP), (33.2 percent increase to $425.11 million). The USGCRP engages thirteen U.S. agencies in efforts to advance basic research, comprehensive observations, integrative modeling, and development of products for decision-makers. FY 2012 investments are increased as part of an NSF's emphasis on clean energy and SEES. Research focuses on: improving knowledge of climate variability and change; understanding of natural and human forces of climate change; improving modeling and predicting capability for conditions and impacts; assessing the Nation's vulnerability to climate change; and providing climate information and decision support tools.

Climate Change Technology Program (CCTP), (144.5 percent increase to $62.96 million). CCTP is a multiagency effort to advance climate change research and development, demonstration, and technology adoption. As part of a FY 2012 clean energy emphasis, NSF participates in all six CCTP goals: reductions in energy end use and infrastructure emissions; reduction in energy supply emissions; carbon dioxide capture and sequestration; reduction of non-carbon dioxide gas emissions; improvements in measuring and monitoring greenhouse gases; and to bolster basic science and strategic research.

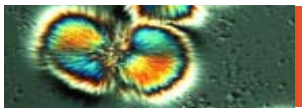
Networking and Information Technology Research and Development (NITRD), (15.3 percent increase to $1,257.67 million). NITRD coordinates the unclassified networking and information technology research and development investments across thirteen federal agencies. Funding foci for FY 2012 include human-computer interaction and information management, high-end computing infrastructure and applications, large scale networking, and cybersecurity and information assurance. Several NSF-wide investments are reflected in these foci, including CIF21, SEES, NRI, EARS, CNCI, and research on advanced manufacturing.

National Nanotechnology Initiative (NNI), (10.6 percent increase to $455.95 million). NNI is coordinated with 25 departments and agencies across the federal government. In FY 2012, NSF increases investments in Nanomanufacturing, Nanoscale Devices & Systems, and Environmental, Health and Safety, and funds the three Signature Initiatives: 1) Nanoelectronics for 2020 and Beyond, 2) Sustainable Nanomanufacturing, and 3) Nanotechnology for Solar Energy Collection and Conversion.

Homeland Security Activities, (9.2 percent increase to $425.85 million). NSF funds homeland security by funding research in two general areas: protecting critical infrastructure and key assets and defending against catastrophic threats. 73 percent of these funds are applied towards research in cybersecurity, emergency planning and response, and risk management, modeling, and simulation of resilient infrastructure.

FY 2012 Interagency Activities
(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request	Change over FY 2010 Enacted Amount	Change over FY 2010 Enacted Percent
U.S. Global Change Research Program	$319.55	-	$319.06	$425.11	$106.05	33.2%
Climate Change Technology Program	27.57	-	25.75	62.96	37.21	144.5%
Networking and Information Technology R&D	1,105.56	-	1,090.48	1,257.67	167.19	15.3%
National Nanotechnology Initiative	428.67	17.72	412.21	455.95	43.74	10.6%
Homeland Security Activities	391.19	-	390.03	425.85	35.82	9.2%



Major Research Equipment and Facilities Construction

In FY 2012, NSF will continue construction of five projects: Advanced Laser Interferometer Gravitational-Wave Observatory (AdvLIGO), the Advanced Technology Solar Telescope (ATST), the Atacama Large Millimeter Array (ALMA), National Ecological Observatory Network (NEON), and the Ocean Observatories Initiative (OOI).

All of the projects in the MREFC account undergo major cost and schedule reviews, as required by NSF guidelines.

- **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 affect Earth's civil life and may impact its climate.
- **Atacama Large Millimeter Array (ALMA).** ALMA, the world's most sensitive, highest resolution, millimeter wavelength telescope, 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.
- **National Ecological Observatory Network (NEON).** NEON will consist of geographically distributed field and lab infrastructure networked via cybertechnology into an integrated research platform for regional to continental scale ecological research.
- **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

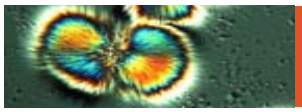
(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request
Advanced Laser Interferometer Gravitational-Wave Observatory (AdvLIGO)	$46.30	-	$46.30	$20.96
Advanced Technology Solar Telescope (ATST)	20.00	146.00	13.00	10.00
Atacama Large Millimeter Array (ALMA)	42.76	-	42.76	3.00
IceCube Neutrino Observatory	2.38	-	0.95	-
National Ecological Observatory Network (NEON)	-	-	-	87.92
Ocean Observatories Initiative (OOI)	20.19	-	14.28	102.80
Other Projects[/1]	34.27	-	-	-
Total, MREFC	**$165.90**	**$146.00**	**$117.29**	**$224.68**

Totals may not add due to rounding.

[/1]Other projects with funding in FY 2010 include the Alaska Region Research Vessel (ARRV) and South Pole Station Modernization (SPSM).

A full-year 2011 appropriation for the MREFC account was not enacted at the time the budget was prepared; therefore, this account is operating under a continuing resolution (P.L. 111–242, as amended). The amounts included for 2011 reflect the annualized level by project provided by the continuing resolution.



Model Organization

The FY 2012 Request includes $493.59 million (an increase of $63.84 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 (a total of 1,365 FTE). No additional IPAs are requested;
- **IT investments** ($85.77 million), such as NSF financial system modernization (iTRAK), Research.gov expansion, and improvements to the operational IT system's reliability and security;
- **Headquarters lease expiration** ($44.65 million), funding to effectively plan and prepare for a new headquarters lease; and
- **Acquisition** ($2.0 million), part of the government-wide effort to strengthen the acquisition workforce, including 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, and sharing publicly available findings online.

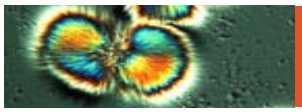
- **Priority Goal:** in FY 2012, NSF's goal to "Improve the education and training of an innovative STEM workforce through evidence-based approaches…" expands to add undergraduate programs to the existing graduate, postdoctoral, and early career level workforce programs. NSF will also work to establish additional priority goals that reflect its overall commitment to STEM workforce development and advancing interdisciplinary research.
- **FY 2011 GPRA Performance Plan:** in the Performance Information chapter, NSF presents the GPRA Performance Plan, the first plan based upon the new NSF strategic plan. The GPRA plan is characterized by its application of experimental approaches towards performance assessment.
- **STAR METRICS (Science and Technology for America's Reinvestment: Measuring the Effect of Research on Innovation, Competitiveness and Science)** is a multi-agency venture to establish a data infrastructure for analyzing federal investments in research and development to a degree not previously possible. In FY 2012, NSF funding will meet commitments to interagency activities for developing this shared infrastructure.
- **Foundation-wide planning, analysis, and evaluation activities**: In FY 2012, NSF will continue to develop a centralized agency assessment and evaluation capacity, and explore ways to more clearly distinguish between process and outcome evaluation through modifications to the agency's Committee of Visitors activity.

Model Organization by Appropriations Account

(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 ARRA Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request	Change over FY 2010 Enacted Amount	Change over FY 2010 Enacted Percent
Agency Operations and Award Management	$299.85	-	$300.00	$357.74	$57.74	19.2%
Office of Inspector General	13.97	0.05	14.00	15.00	1.00	7.1%
National Science Board	4.38	-	4.54	4.84	0.30	6.6%
Research & Related Activities	97.45	-	96.47	100.62	4.15	4.3%
Education and Human Resources	14.83	-	14.74	15.39	0.65	4.4%
Total	**$430.48**	**$0.05**	**$429.75**	**$493.59**	**$63.84**	**14.9%**

Totals may not add due to rounding.



Terminations/Reductions

NSF continually undergoes a portfolio assessment process, in order to ensure that investments are closely aligned with agency priorities and to keep at the cutting edge of innovative science and engineering research. In FY 2012, within the context of evolving programmatic directions, NSF proposes six programs for permanent termination or reduction.

Deep Underground Science and Engineering Laboratory (DUSEL): NSF eliminates funding for DUSEL, which had been pursued in conjunction with the U.S. Department of Energy's (DOE) Office of Science. This termination is based on National Science Board reviews that concluded the cost and scope of DUSEL were inconsistent with the agency's role in advancing fundamental research and education across many fields and disciplines. NSF will continue to solicit proposals for future particle physics research. No funding is required in FY 2012 for DUSEL.

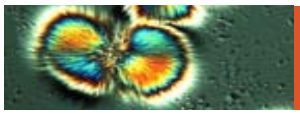
Graduate STEM Fellows in K-12 Education: NSF eliminates the agency-wide Graduate STEM Fellows in K-12 Education (GK-12) program. While the program has been effective in meeting its overall goals, recent evaluation findings indicate that the effects of this program's fellowship experience in improving research skills is mixed, and program design limits the ability of participants to gain in-depth experience in K-12 teaching. NSF plans to build on the experiences gained during the ten years of GK-12 funding to widen the breadth of graduate traineeship experiences through other programs.

National STEM Distributed Learning Program (NSDL): NSF eliminates funding for the NSDL program (formerly the National STEM Digital Library). While NSDL has been successful in meeting its original goals, an October 2010 preliminary evaluation by the RAND Corporation, *Steps Toward a Formative Evaluation of NSDL: Phase* 2, noted the challenges of sustaining the collection in the face of changing technology, and raised concerns about the currency of the collections, peer review of collections, collaboration across pathways, and lack of standardization. NSF plans to build from the substantial NSDL experience to address key areas in cyberlearning through other programs and activities, such as Cyberlearning Transforming Education (CTE). No funding is required in FY 2012 for NSDL.

Research Initiation Grants to Broaden Participation in Biology: NSF eliminates funding for the Research Initiation Grants to Broaden Participation in Biology program (RIG) because it did not achieve the goal of broadening participation in biology; the number of proposals from underrepresented groups did not increase. RIG concludes in FY 2011.

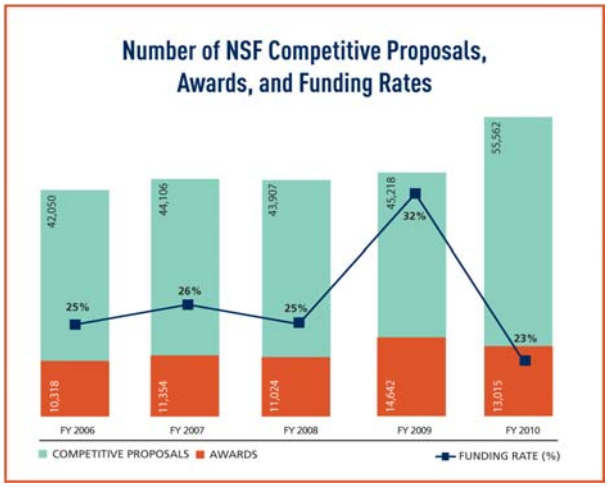
Science of Learning Centers (SLC): NSF proposes to reduce funding for the SLC program, which currently supports six large-scale, long-term centers that conduct science of learning research. The on-going center review process and reviews from an external May 2010 Advisory Committee both recommended that NSF phase the program down as funding for individual centers concludes and shift resources wherever possible to enhance support for the science of learning using non-center mechanisms. NSF expects there may be additional reductions to this program in FY 2013 and beyond, as funding for individual centers comes to a close.

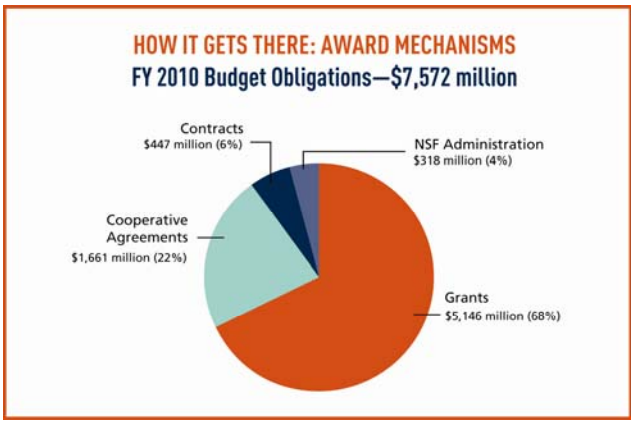
Synchrotron Radiation Center (SRC): NSF eliminates funding for the Synchrotron Radiation Center facility at the University of Wisconsin. The SRC is 30 years old, and more powerful and capable facilities have come on-line since 1980.



NSF by the Numbers

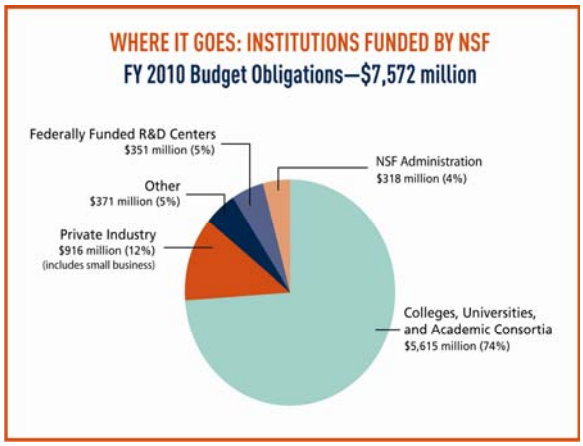
NSF by The Numbers: In FY 2010 NSF evaluated 55,600 proposals through a competitive merit process and made approximately 13,000 new awards. Nearly 287,000 proposal reviews were conducted, and nearly 46,000 members of the science and engineering community participated as panelists and proposal reviewers. NSF awards were made to 2,100 colleges, universities, and other public and private institutions in 50 states, the District of Columbia, and Puerto Rico. NSF supports approximately 294,000 researchers, postdoctoral fellows, trainees, teachers, and students.



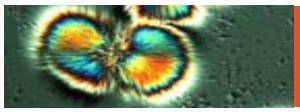


Ninety percent of NSF's FY 2010 projects were funded using grants or cooperative agreements. Grants can be funded either as standard awards, in which funding for the full duration of the project is provided in a single fiscal year, or as continuing awards, in which funding for a multi-year project is 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.

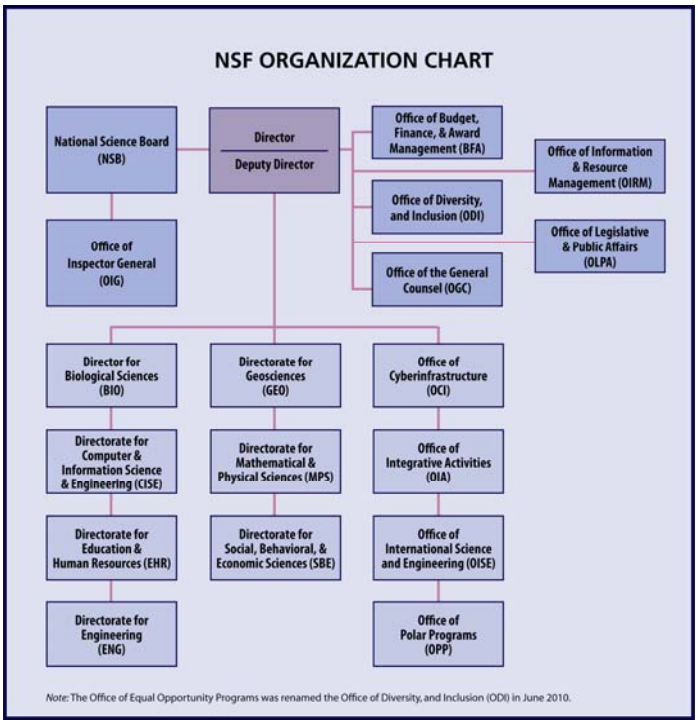


Note: NSF Administration includes three appropriation accounts—AOAM, OIG, and NSB—that support salaries, general operating expenses, and the activities of the OIG and NSB. NSF also funds other operational activities—totaling $112 million in FY 2010—through the R&RA and EHR appropriations. These are principally associated with staff working at NSF under the Intergovernmental Personnel Act and certain NSF-wide activities, including information technology investments that are directly related to programmatic investments. This larger portfolio is captured by the NSF Stewardship goal, which for FY 2010 was $431 million, or 6 percent of NSF's total obligations.



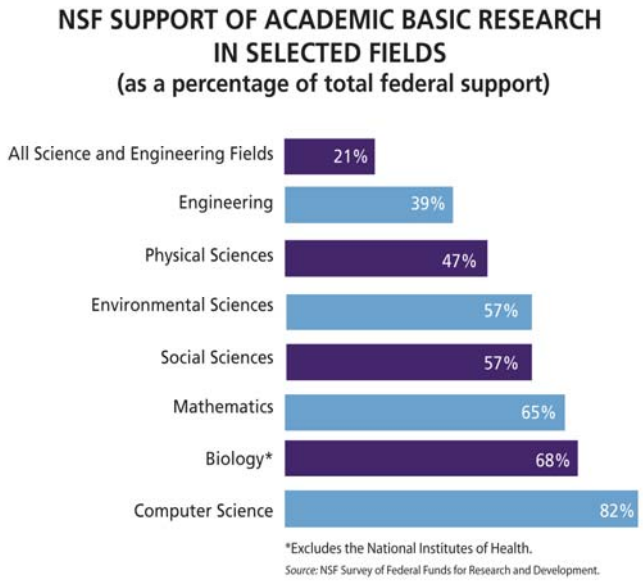
Organization and Role in the Federal Research Enterprise

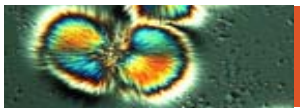
NSF's comprehensive and flexible support of meritorious projects with broad societal impacts enables the Foundation to identify and foster both fundamental and transformative discoveries within and among fields of inquiry. NSF has the latitude to support emerging fields, high-risk ideas, interdisciplinary 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 represents the major science and engineering fields, including: biological sciences; computer and information science and engineering; engineering; geosciences; mathematical 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.

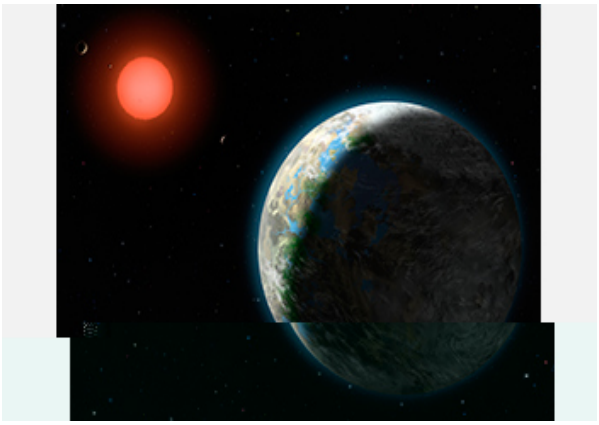




Highlights

Newly Discovered Planet May Be First Truly Habitable Exoplanet

A team of planet hunters announced the discovery of an Earth-sized planet orbiting a nearby star at a distance that places it squarely in the middle of the star's "habitable zone," where liquid water could exist on the planet's surface. The planet (about three times the mass of Earth) is one of six orbiting Gliese 581, a red dwarf star located about 20 light years from Earth. The discovery, led by astronomers at the University of California, Santa Cruz, and the Carnegie Institution of Washington, could be the most Earth-like planet yet found and the first case for a potentially habitable one.



Credit: Artwork by Lynette Cook

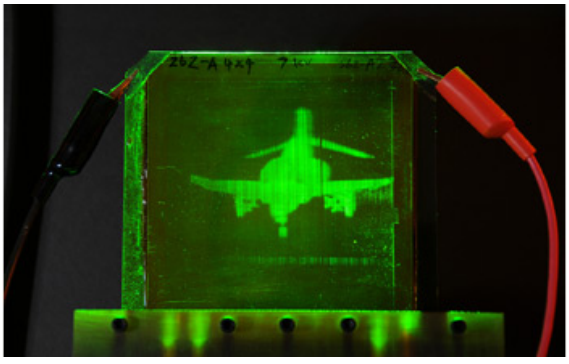
Credit: USDA ARS Image Gallery

Cyberinfrastructure for Research on Long-Term Ecological Phenomena

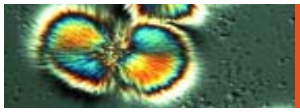
Researchers and students at the NSF CREST Cyber-ShARE Center of Excellence at the University of Texas at El Paso are developing the cyberinfrastructure required to collect environmental data and telemeter it to computer systems. This advances the research efforts at the Jornada Experimental Range, a Long-Term Ecological Research (LTER) site situated in the northern Chihuahuan Desert in southern New Mexico. The new instrumentation measures more than 200 variables including the exchange of energy, water, and carbon dioxide across the land-atmosphere boundary and facilitates linking these measurements with observations made from satellites, and employs software that is based upon algorithms first developed for managing large space missions. These measurements contribute to understanding how desert shrub lands are responding to environmental change and how these changes interact with the climate system.

The Emergence of Holographic Video

Researchers at the University of Arizona, Tucson, have developed a holographic system that can transmit a series of 3-D images in near-real-time, a precursor to holographic videoconferencing. The system can refresh holographic images and is scalable for production—coupled to a unique system for recording and transmitting 3-D images of individuals and objects via Ethernet. And the images can be viewed without special eyewear, such as 3-D glasses.



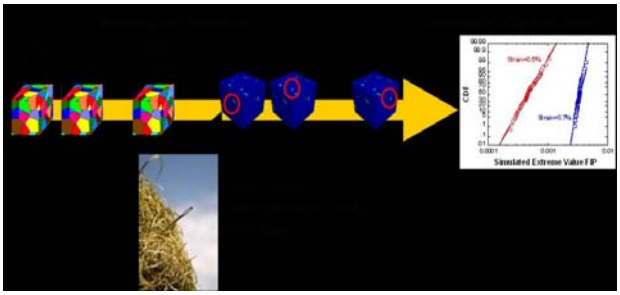
Credit: University of Arizona



Highlights

Modeling and Simulations for Designing Materials against a 'Needle in a Haystack'

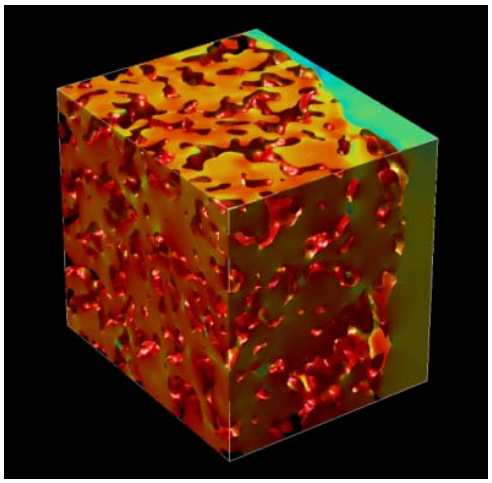
Penn State University and the Georgia Institute of Technology have collaborated under an IUCRC grant to create a model that will create digital simulation of "rare events" ranging from 500 year floods to structural fatigue cracking. The project is focused on designing fatigue resistant materials by running "virtual experiments" that are much less costly and time consuming then their physical counterparts. Their work will assist in accelerated insertion of new or improved fatigue resistant alloys in a range of fields, including aerospace, automotive, and rail applications.



Credit: C. Przybyla and D.L. McDowel

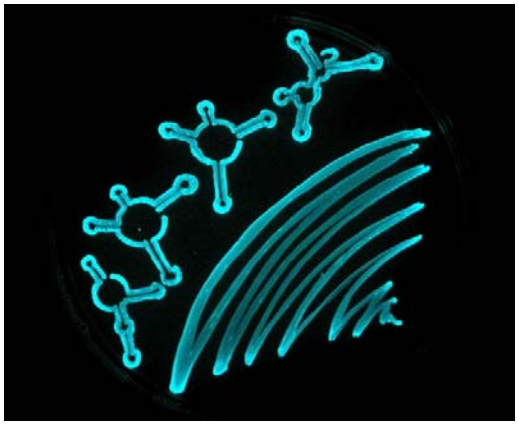
New Methods for Imaging Fuel Cells

Researchers funded by the American Recovery and Reinvestment Act are developing new methods for imaging and characterizing solid oxide fuel cells (SOFCs). SOFCs offer an important new option for converting fuels to electricity with increased efficiency, reduced pollution, and reduced greenhouse gas emissions. Better imaging can be used to determine what structures yield improved performance and hence reduced cost, find manufacturing conditions that yield the desired structure and chemistry, and examine the factors causing fuel cells to degrade over time. The improved structural and chemical information will be disseminated to the fuel cell research and development community where it will help enable critical connections between researchers and developers.



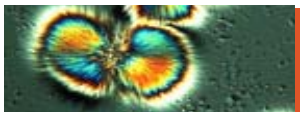
Credit: Katsuyo Thornton, University of Michigan

Scientists Eavesdrop on Bacteria Conversation



Credit: Dr. Jennifer Henke, Princeton University

Bonnie Bassler, a researcher at Princeton University, listens to bacteria talk to one another. It turns out bacteria communicate using a chemical language, and what they are saying amounts to a roll call, or quorum sensing. The tiny organisms form a social network and communicate to count how many of their own kind are present before they try to mount an attack on their host organism. As Bassler explains, bacteria "are too small to have an impact on the environment if they simply act as individuals." Bassler's work in bacterial communication may one day lead to new types of antibiotics.



Highlights

Credit: Patrick O'Connor, Worcester Polytechnic Institute

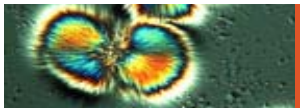
Meet Melvin, the Collaborative Robot

Melvin is a specially constructed humanoid robot that Professor Charles Rich and his students at Worcester Polytechnic Institute are using to investigate human-robot interaction. Melvin has a moveable head, arms and an expressive face, and is mounted on a two-wheeled mobile base. A speaker, microphone array, and stereo camera let it talk, hear, and see. Melvin is connected to several computers that run various kinds of artificial intelligence software, including programs for computer vision, natural language and speech understanding and generation, and planning and dialogue modeling. Together, these programs support autonomous interaction with humans. During the past year, the project has produced the first in a series of reusable open-source software modules, which are being made available to other robotics researchers and developers, so that the human-robot interaction rules discovered in this research can easily be applied to other robots. The first module embodies a set of rules called "engagement recognition," which have to do with noticing appropriate instances of looking and pointing at shared objects and making eye contact during an interaction.

Globally Sustainable Fisheries Possible With Co-Management

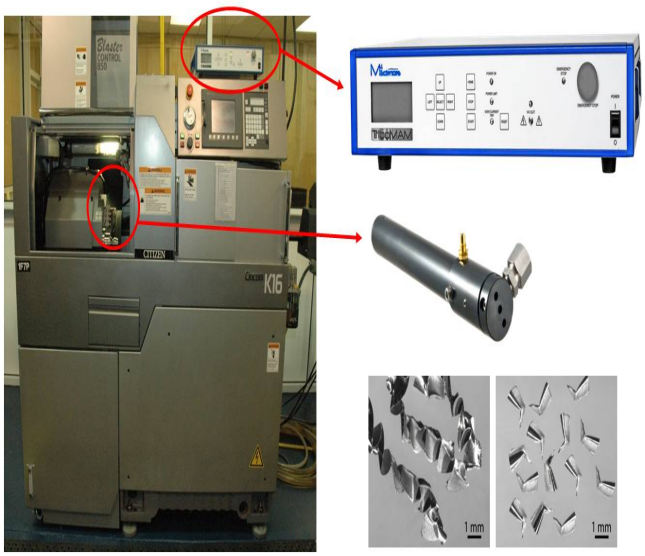
The bulk of the world's fisheries — including the kind of small-scale, often non-industrialized fisheries that millions of people depend on for food — could be sustained using community-based co-management. Under such a management system, responsibility for resources is shared between the government and users. "Our findings show that many community-based co-managed fisheries around the world are well managed under limited central government structure, provided communities of fishers are proactively engaged," says Nicolas Gutiérrez, a University of Washington fisheries scientist and lead author of the report, published in *Nature*. This new work used data on 130 fisheries in 44 developed and developing nations, and included marine and freshwater ecosystems as well as diverse fishing gears and targeted species. Statistical analysis showed that co-management typically fails without prominent community leadership, social cohesion, clear incentives, and protected areas.

Credit: Sebastian Jimenez/DINARA.



Highlights

Transformative Machining Technology for Mechanical Drilling of Meso-scale Holes

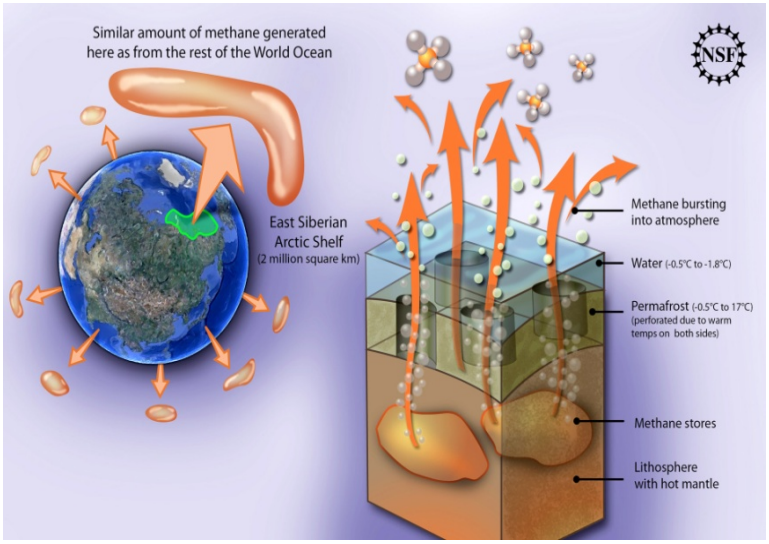


Credit: M4 Sciences LLC

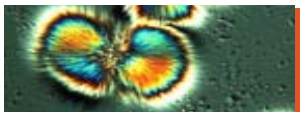
Through an STTR grant, M4 Sciences has created a new manufacturing tool for mechanical drilling of meso-scale holes. The new technique helps fill the demand for creation of smaller parts and features with enhanced performance capabilities. These are useful in a range of fields: in biomedical applications, medical devices must be small so as to be 'minimally invasive'; in electronics, the size of the components dictate the overall system size; and in automotive and aerospace sectors, efficiencies associated with increased strength-to-weight ratios are key drivers. Many products in these sectors incorporate small, complex features including meso-scale holes with length-to-diameter (L/D) aspect ratios typically greater than 10.

Methane Releases From Arctic Shelf May Be Much Larger and Faster Than Anticipated

A section of the Arctic Ocean seafloor that holds vast stores of frozen methane is showing signs of instability and widespread venting of the powerful greenhouse gas, according to the findings of an international research team led by University of Alaska Fairbanks scientists Natalia Shakhova and Igor Semiletov. The research results, published in the journal *Science*, show that the permafrost under the East Siberian Arctic Shelf, long thought to be an impermeable barrier sealing in methane, is perforated and is starting to leak large amounts of methane into the atmosphere.



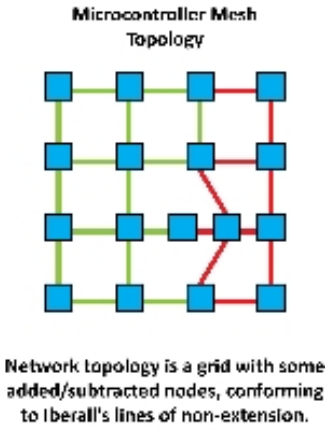
Credit: Zina Deretsky, National Science Foundation



Highlights

Could Clothing Teach Babies With Brain Injury How to Move?

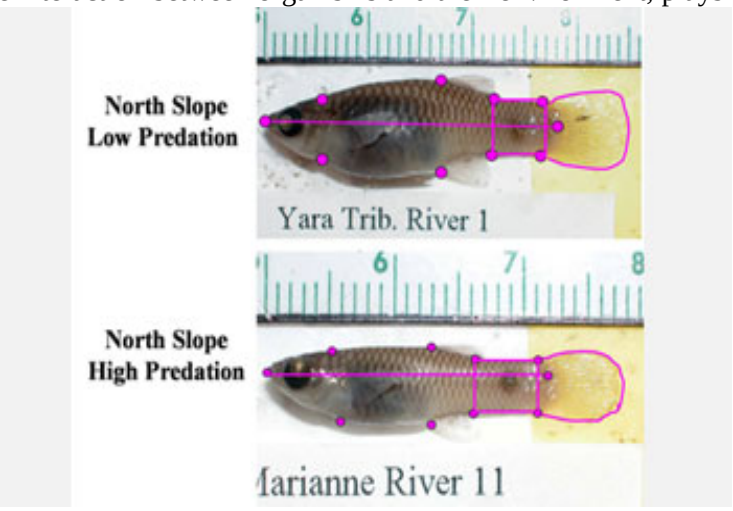
Psychologist Eugene Goldfield of the Center for Behavioral Science at Children's Hospital Boston, along with a team of engineers and scientists at the Wyss Institute, is in the early stages of a project that could help babies with cerebral palsy. Goldfield calls it the "second skin" — smart clothing whose fabric, studded with tiny sensors, would pick up attempts at motion.



Credit: Eugene Goldfield

Evolution Impacts Environment, Study Finds

Biologists have long known that ecology, the interaction between organisms and their environment, plays a significant role in forming new species and in modifying living ones. The traditional view is that ecology shapes evolution. But recently, biologists studying the impacts on artificial streams of guppies from two different stream communities presented evidence that ecology and evolution are reciprocally interacting processes, a fundamental shift in scientists' understanding of the relationship between evolution and ecology. The study documented how rapid, adaptive evolution within single species can cause substantial changes in ecosystem structure and function.



Credit: David Reznick