BIOLOGICAL SCIENCES $633,000,000

The FY 2008 Budget Request for the Directorate for Biological Sciences (BIO) is $633.0 million, an increase of $25.15 million, or 4.1 percent, over the FY 2007 Request of $607.85 million.

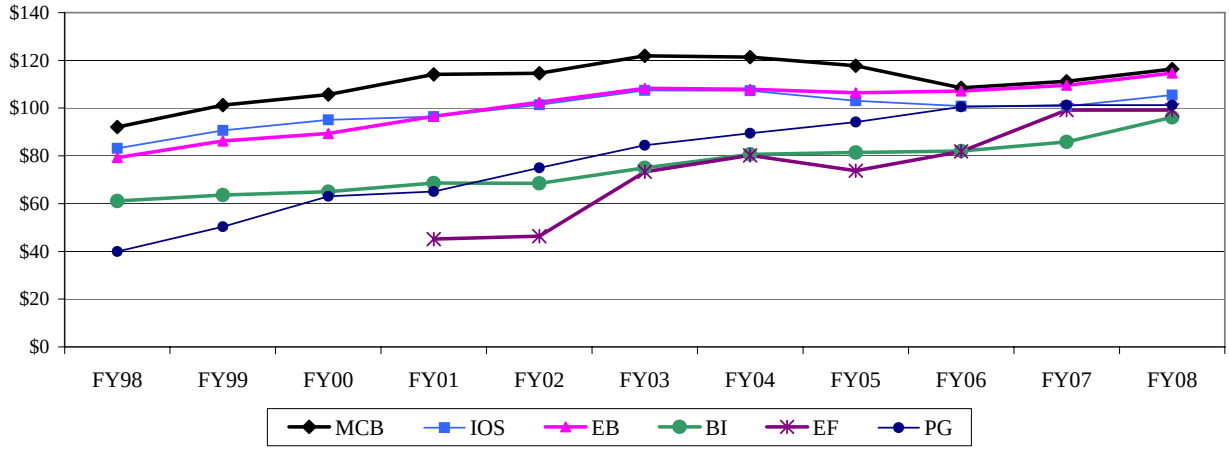
Biological Sciences Funding
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Percent
Molecular and Cellular Biosciences (MCB)	$108.46	$111.22	$116.37	$5.15	4.6%
Integrative Organismal Systems (IOS)	100.83	100.74	105.49	4.75	4.7%
Environmental Biology (EB)	107.21	109.61	114.66	5.05	4.6%
Biological Infrastructure (BI)	82.02	85.90	96.10	10.20	11.9%
Emerging Frontiers (EF)	81.87	99.16	99.16	-	-
Plant Genome (PG)	100.51	101.22	101.22	-	-
Total, BIO	$580.90	$607.85	$633.00	$25.15	4.1%

Totals may not add due to rounding.

The Directorate for Biological Sciences supports research, infrastructure, and education in the biological sciences at U.S. colleges, universities, non-profit research institutions, and other research and education organizations, such as museums and independent field stations. The BIO portfolio includes participation in NSF-wide and interagency research and educational activities, and emphasizes discovery, innovation, and learning aligned with the American Competitiveness Initiative (ACI) and NSF priorities. Research ranges from the study of the structure and dynamics of biological molecules, such as proteins and nucleic acids, through cells, organs and organisms, to studies of populations, ecosystems, and global change. It encompasses processes that are internal and external to the organism and includes temporal frameworks ranging from measurements in real time through individual life spans, to the full scope of evolutionary time. The explosion of biological information and the widespread application of biological concepts in other fields have led some to describe the 21st century as "The Age of Biology."

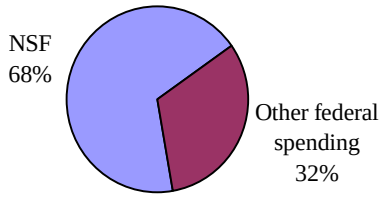
BIO Subactivity Funding
(Dollars in Millions)



RELEVANCE

NSF is the major source of federal funding for non-medical, fundamental biological research at academic institutions, providing 68 percent of all support. Issues of national importance related to the environment, economy, agriculture, and human welfare require an understanding of how living organisms function and interact with non-living systems. BIO-supported research enhances this understanding.

Federal Support for Basic Research in Non-Medical Biological Sciences at Academic Institutions



BIO-supported research advances the frontiers of knowledge, increases our understanding of complex systems, and provides a theoretical basis for frontier research in many other scientific disciplines. Connecting knowledge about individual biological units into networks, from the molecular level to the global scale, is the challenge of the future in biology. Connecting these networks to each other to create a complex biological web of interactions can only be done in the context of all of the biological sub-disciplines working collaboratively with all other fields of science and engineering. The focus on multiple scales of biological organization builds on the current vigor of biological inquiry, but envisions a stronger conceptual basis to this inquiry to uncover basic principles. BIO is well-positioned to define and advance the theoretical and conceptual foundations of the life sciences well into the 21st century.

Biology is rich in theory that forms the foundation for advances in other sciences and engineering. Living organisms have evolved mechanisms for efficiently using energy, producing an endless array of novel compounds, and storing information in miniature, adaptable devices. Fundamental biological research can make this 3.5 billion years of biological innovation available to inform the next generation of nano-, bio-, and information technologies. Biological research leading to the development of novel sophisticated technologies to generate, store, and analyze genetic, cellular, organismal, and ecological data, will stimulate innovation in the physical sciences, engineering, and computer science, a primary goal of the Administration's American Competitiveness Initiative (ACI). For example, as noted in the ACI, harnessing the information stored in the genome requires basic discovery research to understand how that information is encoded. The discoveries at the fundamental level will provide new and important opportunities for the physical sciences and engineering to improve existing tools and develop new computational technologies that will help visualize these complex molecular systems. Similarly, the explosion of heterogeneous data for complex biological systems is providing a rich source of opportunities for developing innovative cyberinfrastructure and enabling breakthroughs in nanotechnology and biotechnology, areas highlighted in the ACI.

BIO is uniquely suited to advance our understanding of complex biological systems, in keeping with the Administration's FY 2008 R&D priorities, through its ability to integrate research across the entire range of biological systems and scales. Biological concepts are integral to wide-ranging areas of science, including national priorities such as nanotechnology, biotechnology, bioengineering, and climate change science. Mathematical modeling and computational simulations have become critical to cutting edge biology by allowing integration of knowledge on non-linear systems such as the biosphere, human social systems, the hydrologic cycle, and the built environment. BIO has made significant contributions to understanding the changing dynamics of the biosphere through investment in interdisciplinary knowledge across biology and sister fields. Continued investment will improve the capabilities for predicting a changing biosphere, and will foster development of broadly-testable theory that links the biosphere, geosphere, and atmosphere in a project like the National Ecological Observatory Network (NEON).

Summary of Major Changes by Division ***(Dollars in Millions)***

FY 2007 Request, BIO.....……...$607.85

Enhanced support for disciplinary and interdisciplinary research across BIO's core programs is the highest priority in the FY 2008 Congressional Budget Request. BIO's funding profile continues to see drops in funding rates for research projects with a decrease to 14 percent in FY 2006. At a time when six of every seven proposals received are declined, enhanced attention to support of cutting edge science is necessary.

Molecular and Cellular Biosciences (MCB) +$5.15

Disciplinary and interdisciplinary research in the MCB core will increase to enhance support for research on living networks and complex molecular and cellular systems, microbial biology, and fundamental plant biology research.

Integrative Organismal Systems (IOS) +$4.75

Disciplinary and interdisciplinary research in the IOS core will increase to emphasize integrative research that focuses on understanding emergent properties of organisms that may be understood through interdisciplinary studies of behavioral, developmental, neural, physiological, and functional systems.

Environmental Biology (DEB) +$5.05

Disciplinary and interdisciplinary research in the DEB core will emphasize ecosystems and global change studies grounded in conceptual frameworks of ecology, phylogeny, and evolution; biodiversity research; and the emerging area of phylobiogeography.

Biological Infrastructure (DBI) +$10.20

Research Resources will increase to support development of tools for theoretical and systems biology research including instrumentation and cyberinfrastructure resources; and NEON development and planning. Human Resources will enhance support for activities to broaden participation in the biological sciences.

Emerging Frontiers (EF) $0.00

Two new activities will be established in EF in FY 2008 (+$8.0 million). Funding will begin at $5.0 million for a Plant Science Cyberinfrastructure Collaborative to enable new conceptual advances through integrative, computational thinking. A total of $3.0 million will support a multidisciplinary Center for Research on the Environmental and Health Safety of Nanotechnology to conduct fundamental research on the interactions between nanoparticles and materials and the living world at all scales. In addition, EF will provide venture funding for transformative research activities at the leading edge (+$10.54 million).

BIO-wide and NSF-wide investments will transition from EF to the core in FY 2008 (-$18.54 million). Broadening Participation programs will shift to the Division of Biological Infrastructure. Biocomplexity in the Environment and Mathematical Sciences will phase out completely as NSF-wide investments in FY 2008. However, components of each investment area – Coupled Natural and Human Systems (CNH) and Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM) – will be transferred to core programs for continued support.

Plant Genome Research Program (PGR) $0.00

Continued support for the interagency maize genome-sequencing project, genome-enabled research that addresses grand challenges in plant biology and takes full advantage of cyberinfrastructure and the latest systems biology approaches, and research collaborations with scientists in developing countries will receive the highest priority. Support will also be provided for the BIO-wide Arabidopsis '2010' project.

Subtotal, Changes +$25.15

FY 2008 Request, BIO……...……..$633.00

Summary of Major Changes in Directorate-wide Investments ***(Dollars in Millions)***

FY 2007 Request, BIO…….....$607.85

Discovery Research for Innovation +$14.20

Support for core BIO research will increase by $14.20 million. Increasing support for basic research in biology will enable the harnessing of 3.5 billion years of biological innovation for the next generation of nano-, bio-, and information technologies. Support of fundamental scientific discovery in biology will have major impacts on quality of life, technological innovation, economic competitiveness, and new job growth – high priorities of the President's American Competitiveness Initiative (ACI). Focus of support will include: unlocking the genetic code; analysis within networks and across scales from cells to societies; theoretical and conceptual bases of biology; and changing dynamics of the biosphere.

A Plant Science Cyberinfrastructure Collaborative will enable new conceptual advances through integrative, computational thinking. With initial funding at $5.0 million, this collaborative will use new computer science, computational science, and cyberinfrastructure solutions to address grand challenges in biology. BIO's investment in this critical activity will involve plant biologists, computer and information scientists, and experts from other disciplines working in integrated teams.

A multidisciplinary Center for Research on the Environmental and Health Safety of Nanotechnology, to be funded at $3.0 million, will conduct fundamental research on the interactions between nanoparticles and materials and the living world at all scales. Companion research on methods and instrumentation for nanoparticle detection, characterization and monitoring will occur. The fundamental research funded through this center will also support the regulatory mission agencies' abilities to develop science-based standards for risk assessments, such as the standards needed by the EPA to regulate products containing nanomaterials.

Preparing the Workforce of the 21st Century +$2.46

BIO will increase support for activities to broaden participation of individuals from underrepresented groups and for programs contributing to the ACI priority goal of enabling superior performance in STEM education by encouraging the best and brightest U.S. students to pursue careers in biology.

Transformational Facilities and Infrastructure +$7.49

An increase of $3.49 million will support development of tools for theoretical and systems biology research including instrumentation and cyberinfrastructure resources and enhance support for physical research resources used by the broad community of biological researchers.

Investment in the National Ecological Observatory Network (NEON) will increase by $4.0 million. The increase will be used to complete site deployment assessments and selection and to complete ongoing R&D projects on environmental sensors and networks, cyberinfrastructure for environmental observatories, and enabling technologies for ecological forecasting.

Stewardship +$1.00

BIO will increase support for administrative activities necessary to enable NSF to achieve its strategic goals. This includes the cost of Intergovernmental Personnel Act appointments and contractors performing administrative functions.

Subtotal, Changes +$25.15

FY 2008 Request, BIO……..……...…….$633.00

NSF-WIDE INVESTMENTS

BIO NSF-wide Investments
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Biocomplexity in the Environment	$30.43	$9.43	-	-$9.43	-100.0%
Climate Change Science Program	15.10	15.10	15.10	-	-
Cyberinfrastructure	84.00	90.50	95.50	5.00	5.5%
Human and Social Dynamics	0.50	0.50	0.50	-	-
International Polar Year	-	2.00	2.00	-	-
Mathematical Sciences	2.21	1.11	-	-1.11	-100.0%
National Nanotechnology Initiative	49.00	52.55	55.55	3.00	5.7%
Networking and Information Technology R&D	77.00	83.50	83.50	-	-

In FY 2008, the Directorate for Biological Sciences will support research and education efforts related to broad, Foundation-wide investments in a number of areas including NSF's multidisciplinary priority areas and the Administration's interagency R&D priorities.

Biocomplexity in the Environment: With the conclusion of this priority area in FY 2007, two components of Biocomplexity in the Environment, Environmental Genomics and Coupled Natural and Human Systems, will be transferred to core programs for continued support. Support will continue within the EF activity for the Assembling the Tree of Life program. In addition, Ecology of Infectious Diseases, Microbial Genome Sequencing, and related activities that support Homeland Security and the

Administration's R&D priorities to develop an integrated, predictive modeling capability for emerging infectious diseases of plants, animals, and humans will continue in EF.

Climate Change Science Program: The Climate Change Science Program, a national research priority highlighted in OSTP/OMB Guidance, was established to respond to the challenge of understanding climate and climate variability. A total of $15.10 million will continue support for research to address key aspects of land use and land-cover change through studies on ecological rates of change and related loss of species diversity. This includes support for programs that specifically address terrestrial ecosystem response to climate change through experimental, modeling, and laboratory studies, including some research activities in the Long Term Ecological Research (LTER) program.

Cyberinfrastructure: Improving high-end computing capability is an important objective of ACI and is expected to increase our understanding of complexity across biological systems by accelerating the pace and nature of biological discovery in the 21st century. A total of $95.50 million, or $5.0 million over the FY 2007 Request, includes support for databases and informatics tools within BIO, including support for the Protein Data Bank (PDB), the international repository and primary source for information about the structure of biological macromolecules, and The *Arabidopsis* Information Resource (TAIR). New FY 2008 funds will provide $5.0 million of initial support for a new Plant Science Cyberinfrastructure Collaborative that will create intellectual synergy among biologists, computer and information scientists, mathematicians, engineers, and others to drive discovery and address the grand challenges in plant science.

Human and Social Dynamics: A total of $500,000 will be provided to support a focus on modeling human and social dynamics that are related to biological systems. HSD research examining the interactions of science and technology with political, economic, environmental, and educational systems will provide a better understanding of how social systems and their constituent parts react to drivers of change. This research directly relates to the ACI objective of strengthening economic competitiveness.

International Polar Year: As part of the International Polar Year (2007-2008), BIO will provide $2.0 million to support research that addresses scientific challenges such as biological adaptation and ecosystem dynamics in polar environments using genomics tools. Support for research on the understanding of environmental change and biotic systems in the polar regions will continue in FY 2008.

Mathematical Sciences: With the conclusion of this priority area in FY 2007, key components of investment in Mathematical Sciences will be transferred to core programs for continued support. This includes support for the Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM) program.

National Nanotechnology Initiative: A total of $55.55 million includes support for research on biosystems at the nanoscale that exhibit novel properties. Potential applications of findings include exploiting functions of cellular organelles and nanoscale sensory systems, and the development of nano-devices for research in genomics, proteomics, cell biology, and nanoscale sensory systems. Continuing attention will be placed on research involving interdisciplinary research teams. FY 2008 funds will create a new, multidisciplinary Center for Research on the Environmental and Health Safety of Nanotechnology to conduct fundamental research on the interactions between nanoparticles and nanomaterials and the living world at all scales.

Networking and Information Technology R&D: A total of $83.50 million will continue support for Human-Computer Interaction and Information Management (HCI&IM) to increase the benefit of

computer technologies to biology; and for Software Design and Productivity (SDP) leading to fundamental advances in concepts, methods, techniques, and tools for software design. These efforts are critical to the future of research technologies relevant to a broad range of scientific disciplines and are related to ACI priorities.

QUALITY

BIO maximizes the quality of the R&D it supports through the use of a competitive, merit-based review process. The percent of research funds that was allocated to projects that undergo external merit review was 97 percent in FY 2006, the last year for which complete data exist.

To ensure the highest quality in processing and recommending proposals for awards, BIO convenes Committees of Visitors (COVs), which are composed of external evaluators who review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of NSF's investments. BIO convened a COV for the Division of Environmental Biology and a second one for the Emerging Frontiers activity in FY 2006.

The Directorate for Biological Sciences also receives advice from the Advisory Committee for Biological Sciences (BIOAC) on such issues as: the mission, programs, and goals that can best serve the scientific community; how BIO can promote quality graduate and undergraduate education in the biological sciences; and priority investment areas in biological research. The BIOAC meets twice a year. Members from academic institutions and industry represent a cross section of biology. The Committee is balanced with respect to gender, underrepresented minorities, and geographic regions.

PERFORMANCE

The FY 2008 Budget Request is aligned to reflect funding levels associated with the Foundation's four strategic outcome goals stated in the FY 2006-2011 Strategic Plan. These goals provide an overarching framework for progress in fundamental research and education and facilitate budget and performance integration.

Biological Sciences

By Strategic Outcome Goal

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Discovery	$423.97	$433.58	$447.78	$14.20	3.3%
Learning	39.18	44.48	46.94	2.46	5.5%
Research Infrastructure	111.47	124.79	132.28	7.49	6.0%
Stewardship	6.28	5.00	6.00	1.00	20.0%
Total, BIO	$580.90	$607.85	$633.00	$25.15	4.1%

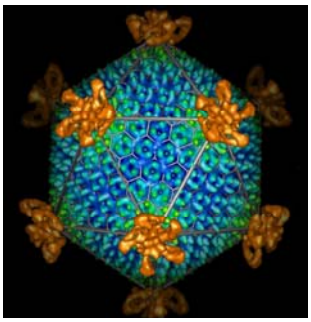
Totals may not add due to rounding.

BIO will continue its commitment to education, training, and increasing diversity while emphasizing the multidisciplinary, computationally sophisticated, complex systems oriented research that characterizes 21st Century Biology within all of its divisions and subactivities. The FY 2008 budget will slightly increase average award size and continue to focus on multidisciplinary research and interagency partnerships and activities, with special attention given to broadening participation at all levels.

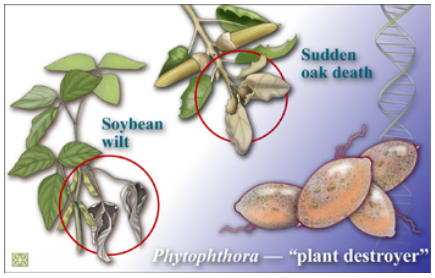
Recent Research Highlights

►From Boiling Acid to Nanotechnology: Newly discovered viruses isolated from microorganisms living in boiling acid pools in Yellowstone National Park are serving as raw materials for amazingly diverse new products, from nanoelectronics to drug delivery systems for cancer treatment. Mark Young and researchers at Montana State University isolated these viruses and studied their practically indestructible protein shells or "cages".

They have now artificially replicated these cages for new applications in nanotechnology. They have used the cages as bases for new platinum catalysts to efficiently produce hydrogen and have made advanced magnetic materials for use in memory devices now in development by Panasonic. The researchers also established SpeciGen, a biotech company, which has exclusive rights to the patented protein cage technology. (MCB).



Structure of a virus from a boiling hot, acid pool in Yellowstone Park. Its protein coat is practically indestructible and is finding many uses. *Credit: Mark Young, Montana State University.*



Scientists have sequenced the genomes from two species of the plant pathogen Phytophthora. *Credit: Zina Deretsky, National Science Foundation.*

► Genome Info from "Plant Destroyers" Could Save Trees, Beans, and Chocolate: An international team of scientists sequenced the first two genomes from a group of plant pathogens called *Phytophthora* – a name meaning "plant destroyer." *Phytophthora* are fungi-like but most fungicides can't kill them. More than 80 species of *Phytophthora* attack a broad range of plants and annually cost the agriculture, horticulture, forestry and nursery industries hundreds of billions of dollars.

Information gained from studying the genomes of *P. ramorum* and *P. sojae* will help scientists devise strategies to combat these and other disease-causing *Phytophthora*. *P. sojae* is responsible for $1-$2.0 billion in soybean losses worldwide each year. *P.ramorum* causes sudden oak death that has devastated the nursery industry and oak ecosystems in California, Oregon and Washington. More than one million native oak and tanoak trees have already died from the disease. The pathogen also destroys an estimated 450,000 tons of cocoa beans, resulting in a $400 million loss in chocolate production each year. (PGR).

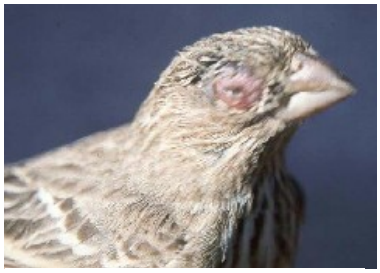
► High School Students Compete in Protein Modeling: In 2005, for the first time, the Wisconsin Science Olympiad included a competition in protein modeling. The competitors used tools and data from the Protein Data Bank, an international repository for protein information, to develop physical models of two proteins and answer questions about each protein's structure, function and importance. Teams were scored on the accuracy of their models and their answers.

The event was conceived and organized by Gary Graper – a retired Madison West High School biology teacher – and the Center for BioMolecular Modeling at the Milwaukee School of Engineering. The success of the protein modeling event, one of 30 in the Olympiad, led to

Wisconsin Science Olympiad contestants used the Protein Data Bank and modeling kits to examine the relationship between protein structure and function. *Credit: Center for Biomolecular Modeling.*

its proposal for inclusion in other state Science Olympiads in 2006 and in the national competition in 2007. (DBI).

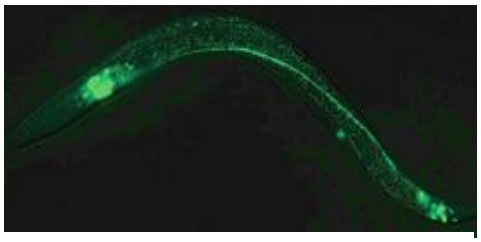
►**Insight into Outbreaks:** Researchers and students at Auburn University and the University of Washington discovered important links between animal genetics, wildlife management, and an emerging infectious disease. Their research involved long-term observations of the eastern house finch, whose population suffered a severe conjunctivitis outbreak in 1993 that killed an estimated 100 million birds.



A female house finch suffering from conjunctivitis due to Mycoplasma gallicepticum infection. *Credit: Geoffrey E. Hill.*

In studying the finch's genome, the researchers uncovered a link between disease resistance and coloration: male finches with brilliant-red feathers recover more quickly from infection than those with more muted hues. Since Eastern house finches are also descendents of California house finches released by New York pet store owners in the 1940s, eastern populations have less genetic diversity than western populations. Comparing these two populations will not only help identify the specific genes involved in the finch's resistance to conjunctivitis but also elucidate how genetic diversity influences resistance. (EF).

►**Neuron Architecture and Brain Function:**
With hundreds of millions of neurons in the mammalian nervous system, neuroscientists often do research on less complex organisms – among them the roundworm *Caenorhabditis elegans* that has just 302 neurons. The neurons of both mammals and roundworms share many properties. Among them are a nucleus, common genes, and a common genetic code.



The transparent nematode, C. elegans, can be genetically engineered to visualize specific neurons using a fluorescent protein from jellyfish, thereby enabling studies into how neuronal cells connect and function in an intact living animal. *Credit: Kim Caldwell.*

Using *C. elegans* Guy Caldwell at the University of Alabama discovered a family of genes that control the position of the nucleus in the cell. He also found that when these genes are turned on, the nucleus shifts position impairing the ability of the neuron to communicate with other neurons. This discovery has implications for human neurological diseases. One of the earliest responses of neurons to injury or disease is movement of the nucleus to the edge of the cell. Understanding how and why such movements occur may suggest ways to prevent or reduce the devastating behavioral consequences of damage to the nervous system. (IOS).

Field assistant Bonnie Dickson collected dissolved carbon dioxide samples in a headwater stream of the Rio Cuerias, Brazil. *Credit: Anthony Aufdenkampe, Stroud Water Research Center.*

►**Amazon Breath – Not What You Expected:** During an extensive geochemical survey of the Amazon basin, NSF-funded scientists recently found that rivers in the region are "breathing" far harder - and cycling the greenhouse gas carbon dioxide far faster - than anyone realized.

Most of the carbon being exhaled as carbon dioxide from Amazonian rivers and wetlands has spent a mere five years sequestered in the trees, plants and soils of the surrounding landscape.

Until these data were collected, explained University of Washington oceanographer Emilio Mayorga, researchers had hoped that regions such as the nearly 2.4 million-square-mile Amazon River basin, where tropical forests rapidly gulp carbon dioxide during photosynthesis, were holding onto that carbon for decades or centuries. Since the five-year time scale is so much shorter than researchers had thought, the work adds important information to the global carbon cycle puzzle. (DEB).

Other Performance Indicators

The tables below show the change in the number of people benefiting from BIO funding along with trends in the award size, duration, and number of awards.

Number of People Involved in BIO Activities

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Senior Researchers	3,477	3,865	4,080
Other Professionals	1,604	1,783	1,882
Postdoctorates	1,314	1,461	1,542
Graduate Students	2,499	2,778	2,932
Undergraduate Students	3,288	3,655	3,858
K-12 Teachers	20	25	30
Total Number of People	12,202	13,567	14,324

BIO Funding Profile

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Statistics for Competitive Awards:			
Number	1,200	1,334	1,408
Funding Rate	18%	19%	20%
Statistics for Research Grants:			
Number of Research Grants	803	892	941
Funding Rate	14%	13%	13%
Median Annualized Award Size	$140,000	$147,000	$147,000
Average Annualized Award Size	$190,670	$200,000	$207,000
Average Award Duration, in years	3	3	3

MOLECULAR AND CELLULAR BIOSCIENCES $116,370,000

The FY 2008 Budget Request for the Division of Molecular and Cellular Biosciences (MCB) is $116.37 million, an increase of $5.15 million, or 4.6 percent, over the FY 2007 Request of $111.22 million.

Molecular and Cellular Biosciences Funding
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Molecular and Cellular Biology	**$108.46**	**$111.22**	**$116.37**	**$5.15**	**4.6%**
Major Components:					
Research & Education Projects	108.46	111.22	116.37	5.15	4.6%

About MCB:

MCB supports research to advance understanding of the fundamental properties and dynamics of biological molecules and cells. This research lays the groundwork for understanding multi-scale, complex, biological systems and their interactions with the physical world. Creative ideas and insights from MCB-supported investigators transform our understanding of the natural world. These advances contribute to our economy through discoveries pointing to new products and processes with applications in biotechnology, nanotechnology, and agriculture and contribute to our ability to detect and defend against biological threats.

Key biological questions include the nature and function of the molecular machinery of living cells, the mechanisms by which genetic information is transmitted and expressed, and the processes by which living cells are organized, communicate, and respond to environmental signals. Answering such complex biological questions increasingly requires the tools of genomics, the physical sciences, mathematics, computer and information science, and engineering, as well as integration of theoretical and experimental approaches.

MCB continues to forge partnerships to support research at the interfaces of these complementary disciplines, to introduce new analytical and conceptual tools for biological research, and to provide unique education and training opportunities for the next generation of researchers, scientific educators, and scientifically literate citizens. Leading edge cyberinfrastructure is indispensable for capturing, storing, manipulating, and analyzing the amounts and diversity of data that are enabling scientists and their students to meet these challenges.

The Molecular and Cellular Biosciences Division supports multidisciplinary research through three scientifically-focused clusters: **Biomolecular Systems**, **Cellular Systems**, and **Genes and Genome Systems**. Within the **Biomolecular Systems** cluster, the use of cutting-edge technologies is a priority to integrate theoretical, computational, and experimental approaches to study biological molecules and their functional complexes (paradigms for nanomachines). Nanoscale studies of the structure, function, and assembly of cellular elements are a priority for the **Cellular Systems** cluster, as is research on cellular mechanisms underlying immune-like defense mechanisms in plants and diverse animals, particularly lower vertebrates and invertebrates. The **Genes and Genome Systems** cluster supports studies of genomes, genome dynamics, and genetic mechanisms in all types of organisms, including vertical and

lateral transmission of heritable information, and the variety of processes that carry out and regulate expression of the information encoded in the genome.

In general, 30 percent of the MCB portfolio is available for new research grants. The remaining 70 percent is used primarily to fund continuing grants made in previous years.

MCB priorities for FY 2008:

Living Networks and Complex Processes: There is growing appreciation that the functions of living cells cannot be understood as a collection of individual, linear processes, but only when viewed as systems of interacting and interdependent networks. MCB will give priority to theoretical, computational, mathematical modeling and simulation approaches for study of molecular and cellular systems. Formulating and testing physical and mathematical models of the structure and function of complex systems of molecules, biochemical pathways, and other exquisitely regulated cellular processes are among the greatest theoretical and computational challenges facing biology in the 21st century.

Microbial Biology: Microbes are both individual cells and components of populations and communities that play critical, though poorly understood roles in the lives of all plants, animals, and ecosystems. Analysis of microbial genomes has provided a key to discovery of new organisms and to appreciation of the diversity of their metabolic functions that enable them to occupy diverse habitats and to interact in complex communities. Undiscovered microbes also represent rich resources of novel products and processes for applications in biotechnology, nanotechnology, and agriculture that will increasingly contribute to U.S. competitiveness. Support for research on microbes at all levels of biological organization is encouraged through the core activities as well as special activities for microbial observatories and microbial interactions and processes NSF programs that support the study of microbes are coordinated with activities of other U.S. government agencies through an interagency working group known as "The Microbe Project."

Plant Biology: Research supported by MCB led to the discovery of the value of *Arabidopsis thaliana* as a model flowering plant. A priority for MCB will be the continued support of broad-based, fundamental, plant biology research, particularly research enabled by the availability of genome sequences and resources developed through the *Arabidopsis* 2010 project and the Plant Genome Research program.

Integration of education and broadening participation in all aspects of molecular and cellular research: These priorities contribute to U.S. competitiveness by making available to the U.S. scientific enterprise the human and intellectual resources represented by all areas of the country, all types of institutions of higher education, and all facets of U.S. society, including those that until now have not been fully involved.

Fundamental research and education at the interface of biology and the physical sciences: In partnership with the Directorate for Mathematics and Physical Sciences, MCB will continue to support beginning investigators whose innovative projects integrate research and education.

Changes from FY 2007:

- Disciplinary and interdisciplinary research and education supported in the MCB core will increase by $5.15 million.

INTEGRATIVE ORGANISMAL SYSTEMS $105,490,000

The FY 2008 Budget Request for the Division of Integrative Organismal Systems (IOS) is $105.49 million, an increase of $4.75 million, or 4.7 percent, over the FY 2007 Request of $100.74 million.

Integrative Organismal Systems Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Percent
Integrative Organismal Systems	**$100.83**	**$100.74**	**$105.49**	**$4.75**	**4.7%**
Major Components:					
Research & Education Projects	96.93	100.74	105.49	4.75	4.7%
Center for Behavioral Neuroscience[1]	3.90	-	-	-	N/A

[1] Moved to EF in FY 2007.

About IOS:

Biology, in the context of the organism, addresses questions that cannot be answered by focusing on the extremes of molecules or ecosystems. Innovations in genomics, molecular biology, and computer science are now enabling advancement of the frontiers of knowledge on an array of complex questions. The Division of Integrative Organismal Systems (IOS) supports research aimed at a comprehensive understanding of organisms. The goal is to predict why organisms are structured the way they are and function as they do with a particular emphasis on emergent properties of organisms, e.g.: **Complexity** - how interwoven organismal components or processes produce more than a sum of their parts; **Robustness** - the degree to which an organism resists perturbation or stressful influences; **Communication** - the processes that enable individual components in a system to instruct one another or alter one another's behavior; **Resilience** – the ability to recover from perturbation or stress; **Adaptability** – the capacity of organisms to change in response to perturbations in ways that maintain overall organismal integrity; and **Cooperation** – the behaviors of cells or organisms that benefit more than an individual.

Understanding these emergent systems properties of organisms requires integrative, interdisciplinary approaches and innovative integration of information across levels of analysis and stages of development, across phyla, environments, and evolutionary time. It can also require computational techniques and interdisciplinary perspectives from other areas of biology, the physical sciences, mathematics, engineering, social sciences, and computer science. These emergent properties can be understood through studies of the evolution, development, behavior, regulatory processes and structural properties of all organisms thus promoting comparative studies and the use of a wide variety of organisms as models.

The focus of IOS on emergent properties of organisms stems from the recognition that advancing our understanding of living systems cannot be achieved merely by enumerating and describing their individual components. IOS researchers are now advancing the frontier of understanding complex, dynamic organismal systems in their natural environments by building on investments in genome sequencing and projects that have accumulated in-depth knowledge of the molecular nature of biological systems. These innovative studies offer potential solutions to many critical national problems such as energy production, carbon sequestration, environmental clean up, improved diagnosis and treatment of disease, as well as better protection of people from environmental hazards. It will allow creation of novel

biochemical processes and the modification of organisms to achieve predictable results. For example, organisms could be modified to serve as sensitive detectors for dangerous pathogens and toxins, or to create novel materials, catalysts, and drugs. Finally, advancing our understanding of how emergent properties arise in organisms may ultimately lead to a paradigm shift in the design, engineering, and production of biomimetic materials and machines, such as highly maneuverable, advanced aircraft.

In general, 39 percent of the IOS portfolio is available for new research grants. The remaining 61 percent is used primarily to fund continuing grants made in previous years.

IOS Priorities for FY 2008:

IOS will place highest priority on highly creative, integrative, and transformative studies that lead to a deeper understanding of the emergent properties of organisms. These properties such as complexity, robustness, communication, resilience, adaptability, and cooperation may begin to be understood through interdisciplinary studies of behavioral, developmental, neural, physiological, and functional systems and how they are integrated to produce living organisms. Studies that cross previously disparate scientific areas and that cross scales of organization from molecules to ecosystems involving a variety of levels of analysis will be highlighted.

Changes from FY 2007:

- Disciplinary and interdisciplinary research in the IOS core will increase by $4.75 million to support highly innovative studies that promise to provide a deeper understanding of the properties emerging from the interactions of the myriad of processes, and structures of living systems.

- The Division name was changed from Integrative Organismal Biology to Integrative Organismal Systems to reflect an enhanced focus on understanding emergent properties of living systems.

ENVIRONMENTAL BIOLOGY $114,660,000

The FY 2008 Budget Request for the Division of Environmental Biology (DEB) is $114.66 million, an increase of $5.05 million, or 4.6 percent, over the FY 2007 Request of $109.61 million.

Environmental Biology Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Environmental Biology	**$107.21**	**$109.61**	**$114.66**	**$5.05**	**4.6%**
Major Components:					
Research & Education Projects	103.76	109.61	114.66	5.05	4.6%
National Center for Ecological Analysis and Synthesis[1]	3.45	-	-	-	N/A

[1] Moved to EF in FY 2007.

About DEB:

The Division of Environmental Biology supports catalytic and transformative research to inventory the diversity of life on earth, to discover its origins and evolutionary history, and to understand the dynamics of ecological systems. This research informs our ability to live sustainably on earth, since ecological systems provide the goods and services upon which human health and welfare depend (e.g., clean water, food and fiber, crop pollination, disease control). Fundamental research on the complex ecological and evolutionary dynamics inherent in environmental systems is crucial to maintaining a vital economy. It improves our ability to forecast environmental change and illuminates options for sustaining and improving ecological systems and related goods and services.

The explosion of biological information and the widespread application of biological concepts in other scientific disciplines is a consequence of both technological and theoretical advances. In Environmental Biology, two fundamental theories define the frontiers of inquiry: the theory that all forms of life evolve by natural selection or genetic drift; and the theory that all life is connected to form functional ecosystems. Advancing both quantitative models and general theory remains a priority for DEB in order to further a predictive capability to address phenomena that occur at scales different from those at which measurements can be made, and to link structure and function in environmental systems.

DEB will continue to balance disciplinary and interdisciplinary needs that NSF supports uniquely or especially well, and foster synthesis and education in environmental biology while promoting full participation of all groups. Scientific foci in DEB address the processes of evolution; describe the genealogical relationships of all life; elucidate the spatial and temporal dynamics of species interactions that govern the assembly of functional communities; and determine the flux of energy and materials through ecosystems. This basic research in ecology, evolution and biodiversity is continually transformed as it incorporates new approaches and tools from genomics, computer, and mathematical sciences.

Research on biodiversity and phylogenetic relationships is time-critical due to the continuing loss of biodiversity. Such research provides a foundation for all environmental biology, serves sister fields such as physiology, neuroscience, conservation, restoration, and disease biology. In addition, phylogenetic

frameworks may provide a predictive understanding of genetic potential and risk, with clear linkages to economically-important processes and products.

DEB also supports the Long-Term Ecological Research (LTER) program, a network of 26 research sites representative of the global range of natural, agricultural, and urban ecosystems. A Network Office coordinates cross-site communication, education, outreach, and international activities, while promoting synthesis via an open access data policy. All LTER projects share common research themes that facilitate multi-site and interdisciplinary activities. A two-year strategic planning exercise has highlighted opportunities for leveraging the network to understand ecosystems as coupled human-natural systems.

In general, 35 percent of the DEB portfolio is available for new research grants. The remaining 65 percent is used primarily to fund continuing grants made in previous years.

DEB priorities for FY 2008:

Understanding environmental change requires comprehension of the ecological and evolutionary mechanisms that sustain ecosystem functions. This requires research that is grounded in conceptual frameworks of ecology, phylogeny, and evolution. In FY 2008, DEB will support activities that: advance theory; address the couplings of systems across different time and space scales, and between human and natural systems; and consider feedbacks between evolutionary and ecological processes.

Characterizing the diversity of life on earth remains a key objective, as does placing this information in the context of a predictive understanding of evolution. In FY 2008, DEB will continue to support biodiversity research through the Planetary Biodiversity competition. Special emphasis will also be given to projects that create new cyberinfrastructure capabilities including continued investment in the LTER network.

Knowledge developed through core support of systematic biology has opened new research frontiers in ecology and evolutionary biology. In FY 2008, DEB will promote this transformational research through enhanced support for the emerging area of phylobiogeography.

DEB will continue to support outstanding projects that integrate education with research. Support will emphasize broad career horizons, experiential learning, and preparing people to understand and apply information about the biological world in their daily lives. DEB will support CAREER grants, Doctoral Dissertation Improvement Grants, and Research Experiences for Undergraduates, and maintain funding for the LTER Schoolyard Science activity to engage students in primary and secondary schools.

Changes from FY 2007:

- Disciplinary and interdisciplinary research in the DEB core will increase by $5.05 million.

BIOLOGICAL INFRASTRUCTURE $96,100,000

The FY 2008 Budget Request for the Division of Biological Infrastructure (DBI) is $96.10 million, an increase of $10.20 million, or 11.9 percent, over the FY 2007 Request of $85.90 million.

Biological Infrastructure Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Percent
Research Resources	51.28	53.58	61.32	7.74	14.4%
Human Resources	30.74	32.32	34.78	2.46	7.6%
Biological Infrastructure	**$82.02**	**$85.90**	**$96.10**	**$10.20**	**11.9%**
Major Components:					
Research & Education Projects	74.90	78.77	84.97	6.20	7.9%
Facilities					
National Nanotechnology Infrastructure Network	0.40	0.40	0.40	-	-
National Ecological Observatories Network	5.93	5.94	9.94	4.00	67.3%
Cornell High Energy Synchrotron Source	0.79	0.79	0.79	-	-

About DBI:

DBI's responsibility is to build and develop innovative scientific infrastructure that empowers the biological research community to advance all fields of biology under the purview of the Directorate for Biological Sciences.

DBI is organized into two clusters. The **Research Resources** cluster supports development of research tools and resources, including informatics tools to provide power to mine all available information, data/biological research resources to be utilized for new insights and discoveries, and instrumentation resources to provide access to the latest instrumentation with new capabilities. In addition, this cluster supports planning for the proposed National Ecological Observatories Network (NEON), and research resource development for the BIO-wide *Arabidopsis* 2010 project. The **Human Resources** cluster supports education activities with the goal of training a new generation of scientists who are open to new and different approaches and ideas across all boundaries ("fearless scientists"). This cluster focuses on integration of research and education, and works closely with the Education and Human Resource Directorate.

The DBI portfolio includes fellowships, instrumentation, and databases, and research grants. Approximately 49% is available for all new awards each year while approximately 23 percent of the DBI portfolio is available for new research grants. The remainder is distributed through grants for various DBI priorities and continuing funding for grants made in previous years.

DBI Priorities for FY 2008:

Research Resources

Cyberinfrastructure has been an integral part of all DBI activities and will continue to be a high priority for FY 2008. This cluster currently supports the following activities:

- Instrumentation Resources supports: (1) Instrument Development for Biological Research (IDBR); and (2) Improvement of Field Stations and Marine Laboratories (FSML). Also, BIO participation in MRI is managed within this subactivity.
- Biological Databases and Informatics supports the design, development, implementation, and use of information resources and tools.
- Biological Research Collections (BRC) supports natural history collections archived at museums, botanical gardens, field stations, and academic institutions that are widely used for biological research and education.
- Living Stock Collections (LSC) supports repositories of research organisms, genetic stocks, seeds, cell lines, and DNA clones that are associated with whole organisms in a collection.
- The *Arabidopsis* 2010 Project is a BIO-wide activity. DBI supports those 2010 projects that build community research resources that are necessary for integrative and systems biology research.
- National Ecological Observatories Network (NEON): Planning activities continue for NEON, a continental-scale research instrument consisting of geographically distributed infrastructure, networked via state-of-the-art communications. Additional detail on NEON can be found in the MREFC chapter.

Human Resources

Broadening participation, and integration of research and education are the two top priorities in DBI. Also, international experiences for participating students and postdocs are especially encouraged.

- Postdoctoral Research Fellowships: In FY 2008, BIO will support Minority Postdoctoral Research Fellowships, and the Theoretical and Computational Biology Research Fellowships.
- Undergraduate Research Mentoring in Biological Sciences (URM): This is an expanded version of the Undergraduate Mentoring in Environmental Biology (UMEB) program. The goal is to provide year-round mentoring in research in any area of biological sciences for undergraduate students, especially those from underrepresented groups.
- Support for Research Experiences for Undergraduate Sites (REU) continues to be a high priority. DBI partners with MPS, ENG, and SBE in supporting increasingly interdisciplinary REU site awards.
- This cluster manages BIO participation of the NSF-wide human resource activities including GK-12 and IGERT.

Changes from FY 2007:

- Research Resources will increase by $3.49 million. The increase will support development of tools for theoretical and systems biology research including instrumentation and cyberinfrastructure resources.
- Investment in NEON will increase by $4.0 million. The increase will complete key infrastructure such as cybernetworks and sensors, as well as continued environmental assessments necessary as BIO begins construction of NEON.
- As with all of BIO's core divisions, DBI will increase by $250,000 to support administrative activities necessary to enable NSF to achieve its strategic goals.
- Human Resources will increase by $2.46 million to support BIO's broadening participation activities including the Research Initiation Grants/Career Advancement Awards activity.

EMERGING FRONTIERS $99,160,000

The FY 2008 Budget Request for the Emerging Frontiers (EF) Subactivity is $99.16 million, which is equal to the FY 2007 Request of $99.16 million.

Emerging Frontiers Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Emerging Frontiers	**$81.87**	**$99.16**	**$99.16**	**-**	**-**
Major Components:					
Research & Education Projects	78.92	78.85	70.85	-8.00	-10.1%
Centers Programs					
National Evolutionary Synthesis Center	2.95	3.00	3.00	-	-
National Center for Ecological Analysis and Synthesis[1]	-	3.46	3.46	-	-
Plant Science Cyberinfrastructure Collaborative	-	-	5.00	5.00	N/A
Center for Research on the Environmental and Health Safety of Nanotechnology	-	-	3.00	3.00	N/A
Center for Behavioral Neuroscience[2]	-	3.85	3.85	-	-
Center for Microbial Oceanography	-	4.00	4.00	-	-
Facilities					
National Ecological Observatories Network	-	6.00	6.00	-	-

[1] Funded in prior years in DEB. [2] Funded in prior years in IOS.

About EF:

Emerging Frontiers supports innovative research, education, and networking activities that are built upon and integrate advances in disciplinary research. By encouraging synergy among disciplines using project, network, and centers models, Emerging Frontiers catalyzes activities at the boundaries of disciplines. EF includes BIO-initiated multidisciplinary activities, centers, and programs that contribute to Homeland Security goals, such as Ecology of Infectious Diseases and Microbial Genome Sequencing.

Centers offer the research community an effective mechanism to undertake long-term scientific research and education activities, to explore better and more effective ways to educate students, and to develop mechanisms to ensure the timely transition of research and education advances made into service in society. Centralization of management of all BIO-funded centers in EF fosters collaboration and integration of research themes, promotes cross-center interaction and learning, and facilitates the sharing of best practices between centers and NSF center managers.

In general, 57 percent of the EF portfolio is available for new research grants. The remaining 43 percent is used primarily to fund continuing grants made in previous years.

EF priorities for FY 2008:

Frontiers in Integrative Biological Research: FIBR continues support for research on major biological questions that are addressed using the creative application of a broad range of strategies and research tools

from within and outside the biological sciences. FIBR projects encompass multiple levels of organization, time and space, and a range of organisms or processes. These projects also use combined experimental and theoretical analyses, and apply interdisciplinary approaches in a single, coherent effort.

Theoretical Biology: This continuing research activity focuses on testing and refining extant biological theory as well as developing new theory and conceptual frameworks that span biological subdisciplines and link with non-biological areas. This activity takes advantage of the information explosion in all areas of biology from genomics to ecological systems and is enabled by new analytical, modeling, simulation, and cyber tools.

Plant Science Cyberinfrastructure Collaborative: As enormous amounts of genomic data have flooded cyberspace, the need for additional centers for analysis and synthesis within biology, with a focus on this genomics data, has become critical. BIO proposes to create a center that will enable new conceptual advances by using new computer, computational science, and cyberinfrastructure solutions to address an evolving array of grand challenge questions in plant science. The central resources of the Collaborative will be computational and cyberinfrastructure capabilities and expertise capable of handling large and heterogeneous plant biology data sets. The Collaborative will be community-driven, involving plant biologists, computer and information scientists, and experts from other disciplines working in integrative teams. Resident social scientists will assess how the members of the Collaborative are interacting and using Collaborative resources.

Center for Research on the Environmental and Health Safety of Nanotechnology: Past experience with agro-biotechnology shows that the commercial exploitation of nanotechnology's vast potential can only succeed if credible information exists on the environmental and health safety aspects of this technology. NSF proposes to create a multidisciplinary center to conduct fundamental research on the interactions between nanoparticles and materials and the living world at all scales. This could include interactions of nanomaterials with cellular constituents, metabolic networks and living tissues, bioaccumulation and its effects on living systems, and the impacts of nanostructures dispersed in the environment on physico-chemical-biological processes and dynamics. Companion research on methods and instrumentation for nanoparticle detection, characterization, and monitoring will occur. The fundamental research funded through this center will also support the regulatory mission agencies' abilities to develop science-based standards for risk assessments, such as the standards needed by the EPA to regulate nanomaterials-containing products that are advertised as anti-microbial.

Changes from FY 2007:

- Funding for two NSF-wide investment areas, Biocomplexity in the Environment and Mathematical Sciences, is being transferred to core activities. Funding for special activities to broaden participation has been transferred to DBI, including the Research Initiation Grants/Career Advancement Awards (RIG/CAA) activity. (-$18.54 million)
- EF will provide venture funding for transformative research activities at the leading edge. (+$10.54 million)
- Centers: Creation of a Center for Research on the Environmental and Health Safety of Nanotechnology to conduct fundamental research on the interactions between nanoparticles and materials and the living world at all scales. Creation of a Plant Science Cyberinfrastructure Collaborative to use advanced computational and cyberinfrastructure capabilities and expertise to craft solutions to an evolving array of grand challenge questions in plant science. (+$8.0 million)

PLANT GENOME RESEARCH $101,220,000

The FY 2008 Budget Request for the Plant Genome Research (PGR) Subactivity is $101.22 million, which is equal to the FY 2007 Request of $101.22 million.

Plant Genome Research Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request Amount	Change over FY 2007 Request Percent
Plant Genome Research	**$100.51**	**$101.22**	**$101.22**	**-**	**-**
Major Components:					
Research & Education Projects	100.51	101.22	101.22	-	-

About PGR:

The Plant Genome Research (PGR) subactivity was initiated in FY 1998, as part of the National Plant Genome Initiative (NPGI). Other participating agencies include United States Department of Agriculture (USDA), Department of Energy (DOE), United States Agency for International Development (USAID), U.S. Forest Service (USFS), and National Institutes of Health (NIH). The NSF program follows the guidelines and objectives of the National Plant Genome Initiative (NPGI). PGR works closely with the other agencies in coordinating funding activities through the Interagency Working Group on Plant Genomes under the auspices of the National Science and Technology Council within Office of Science and Technology Policy (OSTP). NSF, DOE, and USDA often support joint activities, such as the Maize Genome Sequencing project and Gramene, an integrated database for cereals.

The ultimate goal of the NPGI is to understand the structure and function of all plant genes at levels from molecules to organisms and to ecosystems. New knowledge and insights gained from plant genomics will lead to unexpected discoveries and conceptual advances in our understanding of the biology of plants specifically and biology in general.

Basic plant biology is one of the areas for which BIO has major responsibilities, and PGR has had a major impact on plant biology research and education, thereby contributing to increased U.S. competitiveness in the development of a renewable resource-based economy of the future.

Major PGR accomplishments to date include:
- Established the U.S. as the world leader in fundamental research in plant biology;
- Transformed plant biology into a 21st Century science;
- Contributed new discoveries that have formed a basis for the development of improved crop plants and new uses of plants;
- Revitalized plant sciences at U.S. colleges and universities;
- Attracted a new generation of students to plant biology research;
- Catalyzed large multinational collaborative plant genome research projects.

PGR currently supports the following specific activities:
- *Arabidopsis* 2010 Project;

- Comparative genomics;
- Research translating findings from model systems to economically important plants;
- Research addressing grand challenges in plant biology;
- Maize genome sequencing (Jointly with DOE and USDA);
- Community databases in coordination with USDA;
- High throughput methods/techniques/technology for plant biology research;
- Developing country collaboration in plant biotechnology;
- Broadening participation, education, training, and outreach.

In general, 36 percent of the PGR portfolio is available for new research grants. The remaining 64 percent is used primarily to fund continuing grants made in previous years.

PGR priorities for FY 2008:

Scientists have become increasingly able to answer long-standing major questions in biology because of the new tools and information resulting from PGR activities over the past 9 years. Genome-enabled plant biology research that takes full advantage of cyberinfrastructure and the latest systems biology approaches will be a high priority. A closer coordination with DOE, USDA, and USFS is expected in the area of research addressing the non-food use of plants such as biofuels and biomaterials.

Continue Support for Maize Genome Sequencing: PGR will contribute the third and last increment in support of the interagency maize genome-sequencing project that began in FY 2005. Maize is the most economically important crop in the U.S. When completed, the maize genome will become the most complex eukaryotic genome to be sequenced to date, including the human genome.

Continue Support for Genome-enabled Plant Biology Research: Building on the knowledge and research resources/tools accumulated over the last nine years, scientists are poised to tackle grand challenges in plant biology, as defined by the plant science community.

Research Collaborations with Scientists in Developing Countries: PGR will continue to support research collaborations between U.S. scientists and scientists in developing countries with a focus on plant genomics and plant biotechnology. The activity is coordinated with the Office of International Science and Engineering (OISE) at NSF, as well as USAID. The intent of this activity is to support collaborative research linking U.S. researchers with partners from developing countries to solve problems of mutual interest in agriculture, energy, and the environment. To date, PGR has supported research collaborations with scientists from Bolivia, Brazil, Colombia, India, Indonesia, Mexico, Nepal, Nigeria, Peru, Philippines, South Africa, and Sri Lanka.