DIRECTORATE FOR BIOLOGICAL SCIENCES (BIO) $760,580,000
+$48,200,000 / 6.8%

BIO Funding
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Molecular & Cellular Biosciences (MCB)	$125.63	$125.79	$136.39	$10.60	8.4%
Integrative Organismal Systems (IOS)	212.43	212.33	225.37	13.04	6.1%
Environmental Biology (DEB)	142.55	142.56	148.97	6.41	4.5%
Biological Infrastructure (DBI)	126.46	126.18	133.65	7.47	5.9%
Emerging Frontiers (EF)	105.22	105.52	116.20	10.68	10.1%
Total, BIO	**$712.28**	**$712.38**	**$760.58**	**$48.20**	**6.8%**

Totals may not add due to rounding.

About BIO

BIO's mission is to enable discoveries for understanding life. Through investments in innovative and transformative research, BIO advances the frontiers of knowledge in the life sciences by increasing our understanding of complex living systems.

Issues of national importance related to the environment, economy, agriculture, and human welfare require an understanding of how complex living systems function and interact with each other and with non-living systems. Research supported by BIO enhances this understanding. As the physical, computational, mathematical, and engineering fields increasingly use living systems to address their major questions, NSF's robust investment in the non-medical biological sciences becomes increasingly relevant to tackling these multidisciplinary challenges.

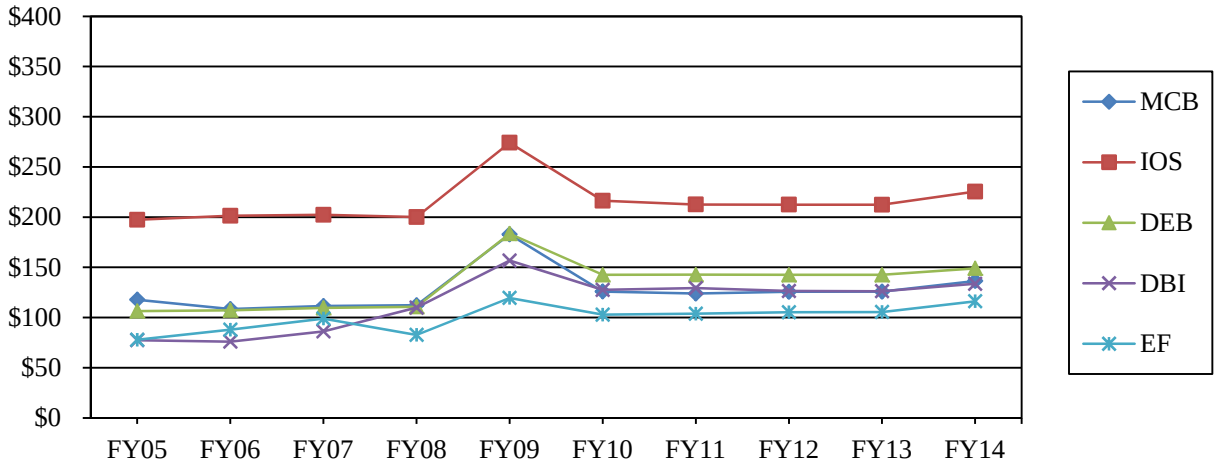
Biological concepts are integral to wide-ranging areas of science essential to human welfare and the bio-economy, including national priorities such as climate science, biotechnology, and bioengineering. Over the last 3.5 billion years, living organisms have evolved mechanisms for efficiently using energy, producing an endless array of novel compounds, and storing information in a highly compact, adaptable format. Fundamental biological research makes these innovations available to inform the next generation of nano-, bio-, and information technologies.

The FY 2014 Request includes projects on understanding the changing dynamics of the biosphere, research on the fundamental characteristics of biological energy systems, and efforts to broaden participation and develop the next generation of biological researchers. This includes research to address the five Grand Challenges in biology: synthesizing life-like systems; understanding the brain; predicting organisms' characteristics from their DNA sequences; elucidating interactions between the earth, its climate and its biosphere; and understanding biological diversity. BIO continues support for Research at the interface of Biological, Mathematical and Physical Sciences, and Engineering (BioMaPS). This interdisciplinary effort, in collaboration with the Directorates for Mathematical and Physical Sciences (MPS) and Engineering (ENG), will result in accelerated understanding of biological systems, leading to innovations in manufacturing in such areas as renewable fuels, bio-based materials, bio-imaging, and bio-inspired sensors. BIO also participates in several NSF-wide investment portfolios, including advanced

manufacturing through the Cyber-enabled Materials and Manufacturing and Smart Systems (CEMMSS) activity; Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21); Clean Energy investments; and Science, Engineering, and Education for Sustainability (SEES).

BIO provides about 64 percent of federal funding for non-medical, basic research at academic institutions in the life sciences, including environmental biology, a research area critical for addressing questions related to climate science.

BIO Subactivity Funding
(Dollars in Millions)



FY 2009 funding reflects both the FY 2009 omnibus appropriation and funding provided through the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

FY 2014 Summary by Division

- MCB's FY 2014 requested increase of $10.60 million, or 8.4 percent, is focused on support for fundamental research to understand the dynamics and complexity of living systems at the biochemical, molecular, and cellular level, which results in foundational knowledge at the heart of the Grand Challenges. Priority has been given to specific BIO-wide activities that emphasize maintaining robust disciplinary programs in cutting-edge areas of research and on interdisciplinary activities that build on disciplinary foundations. MCB will also fund advanced manufacturing through CEMMSS and its breakthrough materials component. MCB's contributions include research such as computational mining of the genomic data from diverse biological systems to identify inspirations for the design and synthesis of new materials with defined properties and capabilities, and predictive synthetic biology to design new nanomaterials, particularly based on photosynthesis and other biological processes.

- IOS's FY 2014 requested increase of $13.04 million, or 6.1 percent, is aimed at fundamental research on organisms as complex integrated systems and their interactions with their social and physical environments, especially as they adapt to climate variability and other environmental factors. In FY 2014, BIO will enhance support for a NSF-wide integrative activity on cognitive science and neuroscience that focuses on three thematic goals: adaptation to changing environments, mechanisms underlying dynamic decisions, and neural coding. Within IOS, a $5.0 million increase will support

research on understanding the brain, including mapping of circuits that drive behavior in a variety of organisms. IOS also maintains its commitment to the Plant Genome Research Program (PGRP), which supports genome-scale research to accelerate discoveries about basic plant biology, as well as downstream applications of societal benefit such as crop improvement, new sources of bio-based energy, and development of novel bio-based materials. Through PGRP, BIO contributes to the National Plant Genome Initiative (NPGI). In conjunction with the Department of Energy (DOE) and United States Department of Agriculture (USDA), NPGI co-sponsors postdoctoral research fellowships that allow recipients to focus their studies in plant genomics with an emphasis on quantitative genetics, modern breeding approaches, and bioinformatics.

- DEB's FY 2014 requested increase of $6.41 million, or 4.5 percent, will provide support for research on complex ecological and evolutionary dynamics to improve our ability to understand the reciprocal interactions between living systems and the environment, and inform essential considerations of environmental sustainability. DEB will sustain support for Dimensions of Biodiversity, including expanding collaborations in Indonesia. Included in this increase is $2.0 million for Strategic Integration for Biological Sciences (SIBS). SIBS planning will emphasize linking legacy and current data streams to enable novel integrative research and meta-analysis.

- DBI's FY 2014 requested increase of $7.47 million, or 5.9 percent, empowers biological discovery by supporting the development and enhancement of biological research resources, human capital, and centers. It reflects an increase in support of NSF's CIF21 investment, active research participation by undergraduate students through the Research Experiences for Undergraduates Sites (REU Sites) program, and continued investment in research to address BIO's five Grand Challenges. DBI will also partner with DEB to provide increased support for SIBS, an effort that networks the growing legacy of biological knowledge in collections with integrative biological research.

- EF's FY 2014 requested increase of $10.68 million, or 10.1 percent, provides support for developing priorities and for operations and maintenance (O&M) for the National Ecological Observatory Network (NEON). EF supports a number of limited-term activities thus allowing for repurposing of funds towards new emphases and for support for facilities. In FY 2014, EF will support: focused activities within SEES, including exploring a new program emphasis on sustainable and resilient food systems; coordination of cross-directorate innovation activities including support for Ideas Labs; and clean energy and advanced manufacturing research through continued directorate-wide support for BioMaPS. EF will also contribute to the NSF-wide framework – Catalyzing Advances in Undergraduate STEM Education (CAUSE) – that consolidates the Foundation's investments in undergraduate education. NEON O&M will increase to $21.0 million during FY 2014, its second year of operations. EF will also provide the U.S. support for the Global Biodiversity Information Facility (GBIF).

Major Investments

BIO Major Investments
(Dollars in Millions)

Area of Investment	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Advanced Manufacturing	$2.00	$2.00	$2.60	$0.60	30.0%
BioMaPS	8.95	9.00	27.07	18.07	200.8%
CAREER	35.90	31.13	33.75	2.62	8.4%
CEMMSS	3.00	3.00	5.00	2.00	66.7%
CIF21	2.00	2.00	6.50	4.50	225.0%
Clean Energy Technology	39.00	39.00	46.00	7.00	17.9%
Cognitive Science & Neuroscience	-	-	5.00	5.00	N/A
I-Corps	0.10	0.50	2.00	1.50	300.0%
INSPIRE	3.06	2.00	4.00	2.00	100.0%
SEES	27.25	27.25	35.75	8.50	31.2%

Major investments may have funding overlap and thus should not be summed.

- Advanced Manufacturing: BIO will provide $2.60 million in advanced manufacturing research through BioMaPS and CEMMSS.

- Research at the Interface of Biological, Mathematical and Physical Sciences, and Engineering (BioMaPS): seeks to discover fundamental new knowledge to enable innovation in national priorities such as clean energy, climate science, and advanced manufacturing. In FY 2014, BIO will increase support by $18.07 million for a total of $27.07 million.

- CAREER: BIO's CAREER awards support young investigators who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations. In FY 2014, BIO will increase support for CAREER by $2.62 million for a total of $33.75 million.

- CEMMSS: BIO support will enable breakthrough materials through research on topics such as computational mining of genomic data from diverse biological systems to identify inspirations for design of new materials, or predictive synthetic biology to design new nanomaterials, particularly based on photosynthesis and other biological processes. BIO will increase support by $2.0 million for a total of $5.0 million for this activity.

- Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21): BIO will increase support by $4.50 million to a total of $6.50 million, and will focus on Software Infrastructure for Sustained Innovation, data-enabled science, Cyberinfrastructure in the Life Sciences (CILS) and SIBS.

- Clean Energy Technology: BIO support for clean energy technology increases by $7.0 million to $46.0 million for fundamental research in areas such as molecular biophysics, photobiology, genetic engineering, and metabolic biochemistry with relevance in areas such as fuel cells, hydrogen,

biomass, and other energy efficiency and use.

- Cognitive Science and Neuroscience: In FY 2014, BIO will enhance support for the thematic goals of a NSF-wide integrative activity on cognitive science and neuroscience: adaptation to changing environments, mechanisms underlying dynamic decisions, and neural coding. Within IOS, a $5.0 million increase will focus on mapping circuits that drive behavior in a variety of organisms.

- I-Corps: BIO will support I-Corps grants to test the feasibility of commercial prototypes developed from NSF/BIO-supported research (+$1.50 million to $2.0 million).

- INSPIRE: BIO will provide support (+$2.0 million to a total of $4.0 million) to co-fund larger cross-disciplinary grants that embody unusually creative high-risk/high-reward research.

- Science, Engineering, and Education for Sustainability (SEES): BIO will support program activities for coastal research, sustainable and resilient food systems, Dimensions of Biodiversity, Coupled Natural & Human Systems (CNH), and SEES Fellows (+$8.50 million to a total of $35.75 million).

BIO Funding for Centers Programs and Facilities

BIO Funding for Centers Programs
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Centers Programs Total	**$41.97**	**$42.22**	**$41.47**	**-$0.75**	**-1.8%**
Centers for Analysis & Synthesis (DBI)	26.09	26.12	26.30	0.18	0.7%
Nanoscale Science & Engineering Centers (DBI)	5.18	5.10	5.10	-	-
Science & Techology Centers (DBI)	9.07	9.00	8.32	-0.68	-7.6%
Science of Learning Centers (DBI)	1.63	2.00	1.75	-0.25	-12.5%

Totals may not add due to rounding.

For detailed information on individual centers, please see the NSF-Wide Investments chapter.

- Centers for Analysis and Synthesis: Funding increases by $180,000 over the FY 2012 Enacted to a total of $26.30 million. The program will support four centers in FY 2014. The increased support represents annual increments for the National Socio-Environmental Synthesis Center (SESynC) established in FY 2012.

- Nanoscale Science and Engineering Centers (NSEC): Support will be continued for the Center for Environmental Implications of Nanotechnology (CEIN).

- Science and Technology Centers (STCs): Support will decrease to $8.32 million for two STCs: the Science and Technology Center for Microbial Oceanography Research and Education (C-MORE) and Bio/computational Evolution in Action CONsortium (BEACON). FY 2014 support for C-MORE decreases (-$680,000 million to a total of $3.32 million) as this center begins a planned FY 2015 sunset.

- Science of Learning Centers: Support will be decreased by $250,000 to $1.75 million, as the center continues to ramp-down to its final year of support in FY 2015.

BIO Funding for Facilities

(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Facilities Total	**$2.05**	**$0.35**	**$21.35**	**$21.00**	**6000.0%**
NNIN	0.35	0.35	0.35	-	-
National Ecological Observatory Network (NEON)	1.70	-	21.00	21.00	N/A

Totals may not add due to rounding.

For detailed information on individual facilities, please see the Facilities chapter.

BIO has increased operations and maintenance funding for facilities in order to provide support for the National Ecological Observatory Network (NEON).

- Funding for NEON operations (+$21.0 million) will support O&M for this project currently in its third year of construction. NEON is constructing a series of 106 sites over twenty domains across the United States. O&M ramps up in FY 2014, as sites are commissioned and validated for delivery of science data through a central cyberinfrastructure portal.

Summary and Funding Profile

In FY 2014, the number of full research grant proposals decreases by 32.4 percent compared to the FY 2013 Estimate due to the implementation of a new proposal submission process. Rather than two deadlines a year for full proposals, BIO instituted one deadline a year for full proposals following an extensive pre-proposal submission review process. This was implemented in two of four divisions in BIO in FY 2012. Pre-proposals are not counted in the numbers cited in the funding profile below. Numbers of total proposals, including both pre-proposals and full proposals, submitted has not appreciably changed. BIO expects to award about 1,050 research grants. Average annual award size and duration will be sustained.

In FY 2014, BIO will invest $41.47 million for centers, accounting for 5.5 percent of the BIO budget. Centers are an important modality for BIO sciences, as research in many BIO-supported disciplines have evolved to be more collaborative and interdisciplinary. In FY 2014, total centers funding decreases from FY 2012 Enacted, as the Center for Microbial Oceanography Research and Education (C-MORE) and Science of Learning Centers have begun planned sunsets.

Operations and maintenance funding for one BIO-supported user facility, NEON, comprises 2.8 percent of BIO's FY 2014 Request.

BIO Funding Profile

	FY 2012 Actual Estimate	FY 2012 Enacted/ Annualized FY 2013 CR Estimate[1]	FY 2014 Estimate
Statistics for Competitive Awards:			
Number of Proposals	5,271	8,000	5,670
Number of New Awards	1,295	1,350	1,500
Funding Rate	25%	17%	26%
Statistics for Research Grants:			
Number of Research Grant Proposals	4,327	6,880	4,650
Number of Research Grants	921	985	1,050
Funding Rate	21%	14%	23%
Median Annualized Award Size	$176,821	$185,000	$185,000
Average Annualized Award Size	$214,157	$230,000	$230,000
Average Award Duration, in years	3.1	3.1	3.1

[1] Award Estimates for FY 2013, such as numbers of awards and size/duration, are based upon the FY 2012 Enacted level.

Note: The calculations for funding rates consist of the number of awards relative only to full proposals submitted and do not include the number of preliminary proposals that are being used with the new review systems implemented in IOS and DEB in FY 2013. If preliminary proposals were incorporated into these calculations, the actual funding rates would be approximately one third of those shown in the table above.

Program Monitoring and Evaluation

Committee of Visitors (COV):

- In FY 2012, BIO held one COV for the Environmental Biology (DEB) division. Recommendations from this COV included: continue efforts to develop new practices to complement standard panels, increase international collaboration, and expand opportunities for young investigators. BIO has addressed these recommendations through enhanced support for international collaborations in programs, such as Dimensions of Biodiversity, as well as through enhancement of programs that support young investigators, such as CAREER.
- In FY 2013, COVs will review the Plant Genome Research Program (PGRP) and the Division of Biological Infrastructure (DBI).
- In FY 2014, COVs will review the Integrative Organismal Systems (IOS) and Molecular and Cellular Biosciences (MCB) divisions.

Program Evaluations:

- In FY 2013, MCB conducted a portfolio analysis to review the geographical, gender, ethnicity, EPSCoR jurisdiction, institution, and young investigator diversity across the division. Final results from this study are expected during FY 2014.

Workshops and Reports:

- IOS funded a workshop entitled “How organisms walk the tightrope between stability and change” at the Banbury Center, Cold Spring Harbor, NY, February 28 – March 1, 2013. The workshop focused on one of the Grand Challenges in organismal biology, genomes to phenomes, and was the first time organismal biologists have considered systematically a quantitative set of approaches in their research agenda. A final report is expected in FY 2013.

The Performance chapter provides details regarding the periodic reviews of programs and portfolios of

programs by external Committees of Visitors and directorate Advisory Committees. Please see this chapter for additional information.

Number of People Involved in BIO Activities

	FY 2012 Actual Estimate	FY 2013 Estimate	FY 2014 Estimate
Senior Researchers	6,686	6,900	7,200
Other Professionals	1,746	1,800	1,900
Postdoctorates	1,560	1,600	1,600
Graduate Students	2,787	2,900	3,000
Undergraduate Students	4,660	4,600	5,000
Total Number of People	**17,439**	**17,800**	**18,700**

DIVISION OF MOLECULAR & CELLULAR BIOSCIENCES (MCB) $136,390,000 +$10,600,000 / 8.4%

MCB Funding

(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Total, MCB	**$125.63**	**$125.79**	**$136.39**	**$10.60**	**8.4%**
Research	**124.49**	**124.56**	**135.16**	**10.60**	**8.5%**
CAREER	12.04	12.74	13.81	1.07	8.4%
Education	**1.14**	**1.23**	**1.23**	**-**	**-**

Totals may not add due to rounding.

MCB supports fundamental research and related activities that promote quantitative, predictive, and theory-driven understanding of complex living systems at the molecular, subcellular, and cellular levels. MCB gives high priority to the research projects that integrate theory, methods, and technologies from physical sciences, mathematics, computational sciences, and engineering to address major biological questions. MCB also seeks to fund research that integrates theory and experimentation to address the emerging areas of synthetic biology, multi-scale integration, molecular and cellular evolution, and quantitative prediction of phenome from genomic information. The division also gives priority to development of methods and resources that will be used to tackle major biological questions, such as how non-living molecular systems converge to create emergent properties of living systems, or how can one predict molecular underpinnings of the impacts of environmental changes. MCB funds research that employs a range of experimental approaches – including *in vivo*, *in vitro* and *in silico* strategies – and a broad spectrum of model and non-model organisms, especially microbes and plants. MCB continues to forge partnerships to support research at the intersection of biology and other disciplines, and to provide unique educational and training opportunities for the next generation of researchers, science educators, and scientifically literate citizens.

In general, 36 percent of the MCB portfolio is available for new research grants and 64 percent is available for continuing grants.

FY 2014 Summary

All funding decreases/increases represent change over the FY 2012 Enacted level.

Research

- Maintaining the health of its disciplinary knowledge base is one of BIO's top priorities. Increased support for foundational biological research in MCB will yield insights that can be used to produce the next generation of nano-, bio-, and information technologies (+$2.99 million).
- MCB will support BioMaPS in partnership with MPS and ENG (+$6.54 million to a total of $6.54 million). Support will be used to foster foundational research activities that employ interdisciplinary approaches, such as Synthetic Biology, which uses chemical and engineering principles to design and construct (or reconstruct) functional molecular and cellular systems with the goal of providing knowledge that leads to major leaps in biotechnology.
- MCB will continue to support CEMMSS research via BioMaPS and the National Nanotechnology Initiative (NNI) by supporting fundamental research on the components and processes that comprise

and control biological systems at the nano to cellular scales. Of particular interest will be research on computational design of biomaterials, as well as development of new approaches to manufacturing economically important chemicals.

- Support for early-career researchers is a BIO priority; MCB will increase investment (+$1.07 million to a total of $13.81 million) in CAREER grants.

Education

- All BIO divisions include support for Research Experiences for Undergraduates (REU) activities. In FY 2014, emphasis will be placed on research experiences for students in their first two years of college.

INTEGRATIVE ORGANISMAL SYSTEMS (IOS) $225,370,000
+$13,040,000 / 6.1%

IOS Funding
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Total, IOS	**$212.43**	**$212.33**	**$225.37**	**$13.04**	**6.1%**
Research	**182.42**	**177.08**	**187.73**	**10.65**	**6.0%**
CAREER	10.07	8.22	8.92	0.70	8.5%
Education	**3.40**	**1.75**	**5.75**	**4.00**	**228.6%**
Infrastructure	**26.61**	**33.50**	**31.89**	**-1.61**	**-4.8%**
Research Resources	26.61	33.50	31.89	-1.61	-4.8%

Totals may not add due to rounding.

IOS supports research and education aimed at understanding the diversity of plants, animals, and microorganisms as complex systems interacting with their environments. Reaching a systems level understanding of organisms will require a new emphasis on interdisciplinary approaches and development of new tools. These approaches span computational, molecular, cellular, individual organism and population levels of inquiry. Many activities supported by IOS focus on biological processes that affect organismal development, structure, performance, and interactions under varying environmental conditions. IOS-supported research focuses on investigating organismal performance in an environmental context, which is significant for understanding reciprocal interactions between the biosphere and drivers of global climate change.

The activities of the Plant Genome Research Program (PGRP) support genome-scale research to accelerate basic discoveries of application to basic plant biology as well as downstream applications of potential societal benefit such as crop improvement, development of new sources of bio-based energy, development of sources of novel bio-based materials, and adaptation to global climate change. The Basic Research to Enable Agricultural Development (BREAD) Program will continue support for basic research to test innovative, early-concept approaches and technologies for sustainable, science-based solution to problems of agriculture in developing countries.

In general, 43 percent of the IOS portfolio is available for new research grants and 57 percent is available for continuing grants.

FY 2014 Summary

All funding decreases/increases represent change over the FY 2012 Enacted level.

Research

- Maintaining a healthy core program is one of the top priorities for BIO, and is reflected in requested increases across all divisions. Research related to the five Grand Challenges will be supported through the IOS core programs with an emphasis on maintaining a balanced award portfolio and broadening participation (+$2.67 million).
- BioMaPS (+$2.28 million to a total of $2.28 million) is a priority area for IOS in FY 2014 and will support research on modeling multi-scale network integration and function.
- IOS supports neuroscience research directed towards the study of biological mechanisms responsible

for complex brain functions. Such mechanisms provide the basis for adaptive responses to changing environments and also drive the evolution of animal behavior. In FY 2014, as part of NSF's Cognitive Science and Neuroscience portfolio, IOS will increase its support of mapping functional neural circuitry in a wide variety of model systems (species) and developmental stages in order to facilitate tool development for functional analyses, which is essential for future technology improvement and progress in this area. Enhanced support will be provided for activities as defined by a "Dear Colleague Letter" released in FY 2013; these can include Research Collaboration Networks (RCNs) and EAGERS (+$5.0 million total).

- Broadening participation will be emphasized across all IOS activities, with an emphasis on support of networking efforts that focus on development of sustainable increases in participation and retention of underrepresented groups and women in science.
- BREAD continues to be supported by NSF ($3.0 million) and the Bill & Melinda Gates Foundation ($3.0 million), through funding provided to NSF.
- Support for early-career researchers is a BIO priority; IOS will increase investment (+$700,000 to a total of $8.92 million) in CAREER grants.

Education

- All BIO divisions include support for Research Experiences for Undergraduates (REU) activities. In FY 2014, emphasis will be placed on research experiences for students in their first two years of college.
- The Plant Genome Research Program (PGRP) provides support for the National Plant Genome Initiative (NPGI) Postdoctoral Research Fellowships Program, which is co-sponsored by NSF, the U.S. Department of Energy (DOE), and the U.S. Department of Agriculture (USDA) – Agricultural Research Service (ARS). This provides training of fellows in plant genomics, with an emphasis on quantitative genetics, modern breeding approaches, and bioinformatics (+$4.0 million).

Infrastructure

- Within infrastructure, the IOS request includes investments in research resources essential to PGRP. A slight decrease in PGRP infrastructure funding will allow for enhanced support for PGRP postdoctoral fellows (-$1.61 million).

DIVISION OF ENVIRONMENTAL BIOLOGY (DEB) $148,970,000
+$6,410,000 / 4.5%

DEB Funding
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Total, DEB	**$142.55**	**$142.56**	**$148.97**	**$6.41**	**4.5%**
Research	**139.89**	**141.06**	**147.47**	**6.41**	**4.5%**
CAREER	6.01	3.34	3.72	0.38	11.4%
Education	**2.66**	**1.50**	**1.50**	**-**	**-**

Totals may not add due to rounding.

The Division of Environmental Biology supports catalytic and transformative research to inventory and document life on earth, to discover life's origins and evolutionary history, and to understand the dynamics of ecological and evolutionary systems. Ecological systems, in turn, provide goods and services upon which human health and welfare depend (e.g., breathable air, potable water, food and fiber, crop pollination, and disease control). Long-term DEB research is critical to understanding the feedbacks between natural and human systems. Scientific foci in DEB also address the processes of evolution; elucidate the integrated dimensions of biodiversity; address 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 theoretical and empirical research in ecology, evolution, and biodiversity is enhanced by dynamic interactions with the fields of genomics, computer science, geoscience, engineering, and mathematics.

In general, 51 percent of the DEB portfolio is available for new research grants. The remaining 49 percent funds continuing grants made in previous years.

FY 2014 Summary

All funding decreases/increases represent change over the FY 2012 Enacted level.

Research

- Supporting research in core programs to address the five Grand Challenges at the interface of the life and physical sciences is a top priority for BIO. In DEB, support increases (+$4.03 million) for fundamental research on the genealogical relationships of all life, and on ecological and evolutionary patterns and processes in the context of changing environmental factors.
- Support for early-career researchers is a BIO priority; DEB will increase investment (+$380,000 to a total of $3.72 million) in CAREER grants.
- DEB will make an initial investment (+$2.0 million to a total of $2.0 million) in planning activities to advance our understanding of life's legacy and future on Earth. Strategic Integration for Biological Sciences (SIBS) will, for the first time, link long-term planetary biodiversity data with specimen/collections data, and with current data streams coming from biodiversity science, phylogenetics, environmental science, paleontology, and atmospheric/climate sciences. This integration will enable novel interdisciplinary research in biodiversity science.

Education

- All BIO divisions include support for Research Experiences for Undergraduates (REU) activities. In FY 2014, emphasis will be placed on research experiences for students in their first two years of college.

DIVISION OF BIOLOGICAL INFRASTRUCTURE (DBI) $133,650,000
+$7,470,000 / 5.9%

DBI Funding
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Total, DBI	**$126.46**	**$126.18**	**$133.65**	**$7.47**	**5.9%**
Research	**49.54**	**47.41**	**49.41**	**2.00**	**4.2%**
CAREER	4.11	5.19	5.63	0.44	8.5%
Centers Funding (total)	41.97	42.22	41.47	-0.75	-1.8%
Centers for Analysis & Synthesis	26.09	26.12	26.30	0.18	0.7%
Nanoscale Science & Engineering Centers	5.18	5.10	5.10	-	0.0%
STC: BEACON	5.07	4.00	5.00	1.00	25.0%
STC: Center for Microbial Oceanography (C-MORE)	4.00	5.00	3.32	-1.68	-33.6%
Science of Learning Centers	1.63	2.00	1.75	-0.25	-12.5%
Education	**20.97**	**19.81**	**21.12**	**1.31**	**6.6%**
Infrastructure	**55.95**	**58.96**	**63.12**	**4.16**	**7.1%**
NNIN	0.35	0.35	0.35	-	0.0%
Research Resources	55.60	58.61	62.77	4.16	7.1%

Totals may not add due to rounding.

DBI empowers biological discovery by supporting the development and enhancement of biological research resources, human capital, and centers. In particular, DBI supports the development of, or improvements to: research infrastructure, including instruments, software, and databases; and improvements to biological research collections, living stock collections, and field stations and marine labs. In addition, DBI funds the development of human capital through support of undergraduate, graduate, and postdoctoral research experiences. Support of center and center-like activities creates opportunities to address targeted but deep biological questions that have major societal impact.

In general, 28 percent of the DBI portfolio is available for new research grants and 72 percent funds continuing grants made in previous years.

FY 2014 Summary

All funding decreases/increases represent change over the FY 2012 Enacted level.

Research

- DBI is home to a number of Centers activities. This portfolio totals $41.47 million in FY 2014; support for the Center for Microbial Oceanography Research and Education (C-MORE) STC decreases as it begins a planned sunset with final funding in FY 2015. Support for the Science of Learning Center also decreases as this activity continues to ramp down to its final year of funding in FY 2015.
- Support for early-career researchers is a BIO priority; DBI will increase investment (+$440,000 to a total of $5.63 million) in CAREER grants.

Education

- Funding for the Research Experiences for Undergraduates (REU) Sites and Supplements program is increased $1.31 million over the FY 2012 Enacted. This additional funding will support enhanced research experiences for students in their first two years of college, as recommended by the President's Council of Advisors on Science and Technology (PCAST) in their report, *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics*.

Infrastructure

- BIO will remain actively involved in CIF21 investments. DBI support for CIF21 (+$4.50 million to a total of $6.50 million) will focus on Software Infrastructure for Sustained Innovation, data-enabled science, planning activities for cyber-infrastructure for the life sciences, and Strategic Integration for Biological Sciences (SIBS).
- Funds are redirected from lower priority areas (-$340,000) to support these activities.

EMERGING FRONTIERS (EF)

$116,200,000
+$10,680,000 / 10.1%

EF Funding
(Dollars in Millions)

	FY 2012 Actual	FY 2012 Enacted/ Annualized FY 2013 CR	FY 2014 Request	Change Over FY 2012 Enacted Amount	Change Over FY 2012 Enacted Percent
Total, EF	**$105.21**	**$105.52**	**$116.20**	**$10.68**	**10.1%**
Research	**85.53**	**88.57**	**82.25**	**-6.32**	**-7.1%**
CAREER	3.67	1.64	1.67	0.03	1.8%
Education	**5.63**	**6.50**	**2.50**	**-4.00**	**-61.5%**
Infrastructure	**14.05**	**10.45**	**31.45**	**21.00**	**201.0%**
Research Resources	12.35	10.45	10.45	-	0.0%
Facilities Pre-Construction Planning (total)	1.70	-	21.00	21.00	N/A
National Ecological Observatory Network	1.70	-	21.00	21.00	N/A

Totals may not add due to rounding.

EF identifies, incubates, and supports infrastructure and research areas that transcend scientific disciplines and/or advance the conceptual foundations of biology. It is also responsible for high-risk high-profile projects, such as NEON, that require additional oversight mechanisms. Typically, developing programs and priority areas begin in EF and then shift to other BIO divisions to become part of the disciplinary knowledge base. An example includes the BioMaPS program, which is transitioning to core divisions. EF also facilitates the development and implementation of new forms of merit review and mechanisms to support transformative research and stimulate creativity. These goals are accomplished by promoting cultural change within and across scientific disciplines to increase and strengthen multidisciplinary collaborations, encourage curiosity and exploration through novel mechanisms and investments, and facilitate support of research areas relevant to all of biology by targeted co-funding throughout the directorate.

In general, 68 percent of the EF portfolio is available for new research grants. The remaining 32 percent funds continuing grants made in previous years.

FY 2014 Summary

All funding decreases/increases represent change over the FY 2012 Enacted level.

Research

- Support for early-career researchers is a BIO priority; EF will increase investment (+$30,000 to a total of $1.67 million) in CAREER grants.
- EF funding in BioMaPS (+$9.25 million to a total of $18.25 million) will produce the knowledge base for synthetic biology and the bioeconomy that is required to catalyze the emerging technologies essential to the Nation's prosperity and economic competitiveness. BioMaPS will foster research in all areas at the intersections by funding unsolicited transformative ideas in the core programs, and will provide additional stimulation for key research and training activities in emerging research fields that are ready for major growth.
- Through BioMaPS, EF contributes to both clean energy research, by supporting research on novel processes used by living organisms to capture and transduce energy, and advanced manufacturing

research, by supporting activities that aim to understand the components and processes that comprise and control biological systems from the nano to cellular scales.

- EF will support SEES (+$8.50 million to a total of $28.75 million) through, the Dimensions of Biodiversity program, Dynamics of Coupled Natural and Human Systems, coastal research, and community planning activities for a potential focus area on sustainable and resilient food systems.
- EF will provide continued support for MacroSystems Biology.
- EF will support U.S. participation in the Global Biodiversity Information Facility (GBIF).
- Funds are redirected from lower priority research areas (-$24.10 million) to support these activities along with support for infrastructure, specifically NEON O&M.

Education

- In FY 2014, NSF is adopting a comprehensive agency-wide framework – Catalyzing Advances in Undergraduate STEM Education (CAUSE) – that consolidates the Foundation's investments in undergraduate education. While the majority of funding for CAUSE is provided through the EHR Directorate, other NSF directorates contribute directly to this effort, ensuring an enduring connection to established discipline-based activities and expertise. In FY 2014, BIO's total funding of $2.50 million (formerly for the Transforming Undergraduate Biology Education (TUBE) program) will be integrated into to the CAUSE activity. Under the CAUSE framework, BIO will focus on developing (with the National Institutes for Health (NIH) and the Howard Hughes Medical Institute (HHMI)) the Partnerships for Undergraduate Life Sciences Education (PULSE).

Infrastructure

- Funding for NEON operations (+$21.0 million) will support year two of O&M for this project currently in its third year of construction. NEON is constructing a series of 106 sites over twenty domains across the United States. O&M ramps up in FY 2014, as sites are commissioned and validated for delivery of science data through a central cyberinfrastructure portal.
- Continued funding will be provided for an activity in support of digitization of scientific information associated with biological specimens held in U.S. research collections. This program began in FY 2009 with funding from the American Recovery and Reinvestment Act (ARRA). FY 2014 investments will be guided by a strategic plan developed by the community and released in FY 2010, as well as an implementation plan released in FY 2013.