

DIRECTORATE FOR BIOLOGICAL SCIENCES (BIO)**\$708,520,000**
-\$12,750,000 / -1.8%**BIO Funding**

(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	FY 2014 Estimate	
				Amount	Percent
Molecular & Cellular Biosciences (MCB)	\$123.40	\$129.68	\$128.58	-\$1.10	-0.9%
Integrative Organismal Systems (IOS)	\$204.50	215.74	218.19	2.45	1.1%
Environmental Biology (DEB)	\$133.26	138.87	137.52	-1.35	-1.0%
Biological Infrastructure (DBI)	\$121.16	132.33	136.67	4.34	3.3%
Emerging Frontiers (EF)	\$96.90	104.65	87.56	-17.09	-16.3%
Total, BIO	\$679.21	\$721.27	\$708.52	-\$12.75	-1.8%

About BIO

BIO's FY 2015 Request is guided by four key priorities for enhanced investments: strengthening foundational (core) research programs through targeted investment in the BIO-wide "Five Grand Challenges" activity; coalescing a major NSF-wide collaboration to support research in Cognitive Science and Neuroscience; stimulating research at the interface of the biological, mathematical and physical sciences, and engineering, as a foundation for synthetic biology and the bioeconomy; and providing critical research infrastructure and support for cyberinfrastructure, including the National Ecological Observatory Network (NEON).

BIO continues to emphasize enhanced support of core programs through focused investments in the Five Grand Challenges in Biology. Each of these challenges is tied to major cross-NSF or BIO initiated activities: 1) synthesizing life-like systems (Synthetic Biology and Research at the Interface of Biological, Mathematical and Physical Sciences (BioMaPS)); 2) understanding the brain (Cognitive Science and Neuroscience); 3) predicting organisms' characteristics from their DNA sequences (Genomes to Phenomes); 4) elucidating interactions between the earth, its climate and its biosphere (the National Ecological Observatory Network (NEON) and Science, Engineering, and Education for Sustainability (SEES)); and 5) understanding biological diversity (Dimensions of Biodiversity/SEES/Strategic Innovation in Biological Sciences (SIBS)).

In FY 2015, BIO will emphasize within core funding three major activities. The first of these is an increased investment in fundamental research directed towards understanding the neural circuitry and neural activity that underlie cognition, behavior, and thoughts. BIO plays a major role in the NSF-wide Cognitive Science and Neuroscience activity that aims to make major investments in collaborative multi-disciplinary science and innovative technology development that will revolutionize our understanding of the brain, particularly how it is remodeled in the context of rapidly changing environments. Cognitive Science and Neuroscience addresses the critical challenge of integrating research and innovation across multiple scales, ranging from the molecular to the behavioral, to accomplish the ultimate goals of establishing integrative and predictive theories of brain structure and function that will ultimately be applied to maintain and restore the healthy brain. BIO funding focuses on research to better understand the genetic, molecular, and cellular mechanisms responsible for brain evolution, development, function, and behavior.

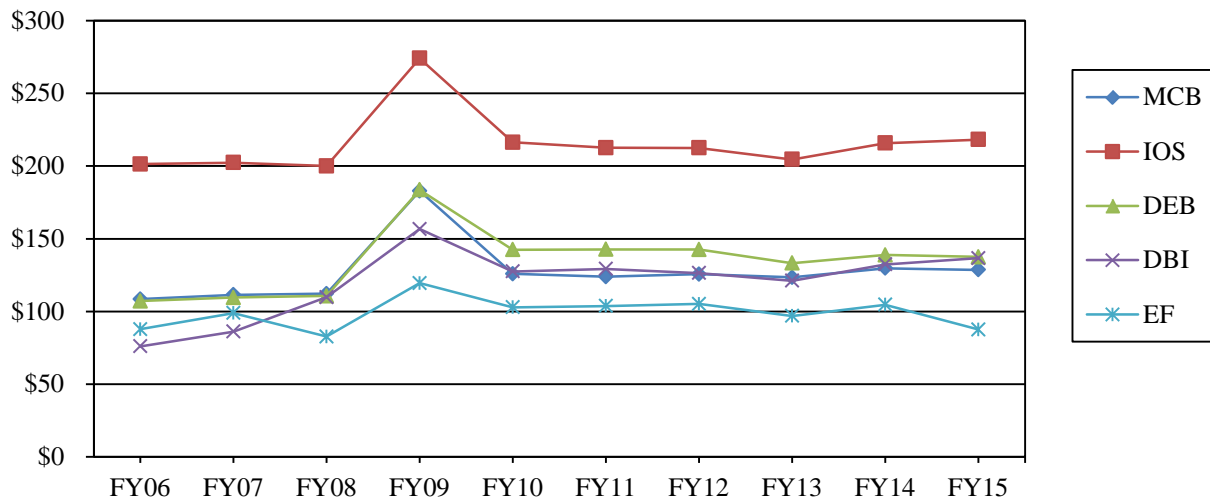
Second, BIO will continue investment in BioMaPS, which seeks to discover fundamental quantitative

knowledge at the intersections of the biological, mathematical and physical sciences, and engineering. BioMaPS will provide the foundational knowledge for synthetic biology and the bioeconomy that is required to catalyze emerging technologies essential to the Nation's prosperity and economic competitiveness. In FY 2015, BIO will enhance investment in certain areas as it has become increasingly essential and urgent that we understand environmental impacts, evolutionary consequences, and societal response to synthetic biology products and organisms. These areas include, in addition to synthetic biology: innovative research on the understanding of ecological impacts of synthetic organisms, the integration of evolutionary thinking in the design-build-test cycles used in synthetic biology, and the application of synthetic biology approaches in ecological and environmental research.

The third major investment BIO will emphasize in FY 2015 is support for cyberinfrastructure and other BIO infrastructure, such as NEON and centers, as they provide the cutting edge tools to address the BIO research challenges. Support is provided through the following programs: SIBS; Digitization of Biological Collections (iDigBIO); iPlant; Field Stations and Marine Laboratories; and Synthesis Centers, such as the National Socio-Environmental Synthesis Center (SESyNC), that foster integration of the social sciences with the biological sciences. In particular, an increased investment in SIBS will provide support for cyberinfrastructure, research resources, and centers that will develop the cutting-edge tools that will enable critical basic research and infrastructure across the spectrum, from collection and preservation of biological specimens to large-scale databases, modeling, and meta-analyses, that will in turn allow researchers to answer questions that were unanticipated just a few years ago. SIBS will explicitly promote activities that explore linkages among biological patterns and processes across multiple scales of biological complexity and over ecological and evolutionary time scales.

BIO provides about 66 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 2015 Summary by Division

- MCB's FY 2015 request will focus support on interdisciplinary research at the heart of all grand challenges and bioeconomy. Priority will be given to interdisciplinary activities that build on MCB's disciplinary foundations, with grants in traditional disciplinary areas of molecular and cellular biology made a lower priority. MCB will also fund advanced manufacturing through Cyber-enabled Materials, Manufacturing, and Smart Systems (CEMMSS) and its breakthrough materials component. MCB's contributions include research such as computational mining of the biological data from diverse biological systems to identify inspirations for the design and synthesis of new materials with defined properties and capabilities, as well as predictive synthetic biology to design new nanomaterials, particularly based on photosynthesis and other biological processes.
- IOS's FY 2015 request is focused on support for neuroscience, including the Administration's BRAIN Initiative. In FY 2015, BIO will enhance support for an NSF-wide Cognitive Science and Neuroscience activity that focuses on four thematic goals: development of innovative neurotechnologies; fundamental relationships among neural activity, cognition, and behavior; how the brain responds and adapts to a changing environment and recovery of functionality; and training next generation scientists. Other IOS research is aimed at fundamental studies of 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.
- DEB's FY 2015 request will emphasize 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. Investment will continue for SIBS, an activity that emphasizes linking legacy and current data streams to enable novel integrative research and meta-analysis.
- DBI's FY 2015 request empowers biological discovery by supporting the development and enhancement of biological research resources, human capital, and centers. It includes a transfer of the Advanced Digitization of Biodiversity Collections (ADBC) program from EF and initiation of support for the new STC, Center for Biology with X-Ray Lasers (XFEL). In addition, support will be maintained for Cyberinfrastructure Framework for 21st Century Science, Engineering, and Education (CIF21); active research participation by undergraduate students through the Research Experiences for Undergraduates Sites (REU Sites) program; and continued investment in BIO's Five Grand Challenges. DBI will also partner with DEB to provide increased support for SIBS.
- EF's FY 2015 request supports a number of limited-term activities, thus allowing for repurposing of funds towards new emphases including support for facilities. In FY 2015, NEON Operations and Maintenance (O&M) increases to a total of \$38.0 million, as approximately half of construction is complete and NEON ramps up operations. EF will also maintain investments in certain areas of SEES, notably Coupled-Natural & Human Systems (CNH) and Dimensions of Biodiversity, while other areas begin to phase-down. Support for MacroSystems Biology will be significantly reduced while BioMaPS will be maintained and expand focus to the environmental impacts of synthetic biology. Support for the ADBC transfers to DBI.

Major Investments

BIO Major Investments

(Dollars in Millions)

Area of Investment	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over FY 2014 Estimate	
				Amount	Percent
Advanced Manufacturing	2.40	2.60	2.60	-	-
BioMaPS	12.50	14.31	14.31	-	-
CAREER	40.12	35.52	35.93	0.41	1.2%
CEMMSS	4.50	4.75	4.50	-0.25	-5.3%
CIF21	3.75	6.16	3.75	-2.41	-39.1%
Clean Energy Technology	41.00	46.00	47.20	1.20	2.6%
Cognitive Science and Neuroscience	-	5.00	9.50	4.50	90.0%
I-Corps	1.15	1.90	1.00	-0.90	-47.4%
IUSE ¹	-	2.50	2.50	-	-
<i>Transforming Undergraduate Biology Education (TUBE)</i>	3.90	-	-	-	N/A
NRT ²	4.57	3.93	3.31	-0.62	-15.8%
SEES	31.00	31.00	21.00	-10.00	-32.3%

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

¹ TUBE is consolidated into IUSE in FY 2014.

² The FY 2013 Actual represents Integrative Graduate Education and Research Traineeship (IGERT) program funding. Outyear commitments for IGERT are included in the NRT line and are \$3.25 million in FY 2014 and \$2.60 million in FY 2015.

- **Advanced Manufacturing:** BIO will provide \$2.60 million in advanced manufacturing research through BioMaPS and CEMMSS.
- **BioMaPS (\$14.31 million):** This NSF-wide investment seeks to discover fundamental new knowledge to enable innovation in national priorities such as clean energy, climate science, and advanced manufacturing. In FY 2015, BIO will maintain support for this activity while enhancing and broadening its research investment. One area of emphasis will be synthetic biology, which is a convergent area at the intersection of biology, engineering, and physical sciences that informs our ability to design and build novel biological functions and systems using engineering principles. It is a transformational advance in which an expanding bioeconomy for the Nation will be based. Synthetic biology promises to develop a wide range of economically viable agricultural, industrial, and environmental, energy, and health applications. As many synthetic biology products, such as food additives, biofuels, drugs, and applications to prevent insect borne diseases are now close to commercialization, it is becoming increasingly essential and urgent that we understand environmental, evolutionary, and societal contexts of synthetic biology products and organisms. In addition, synthetic biology is also opening up new avenues of enquiry and experimental approach that promise to advance fundamental knowledge about biological processes linking genome to phenome.
- **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 2015, BIO will increase support for CAREER by \$410,000 over the FY 2014 Estimate, for a total of \$35.93 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 support totals \$4.50 million (\$250,000 below the FY 2014 Estimate).
- CIF21: BIO support of \$3.75 million (\$2.41 million below the FY 2014 Estimate) 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 \$1.20 million over the FY 2014 Estimate, to \$47.20 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: (+\$4.50 million, for a total of \$9.50 million) In FY 2015, this cross-foundation activity draws together under one management framework ongoing activities, FY 2014 investments, and NSF's contributions to the Administration's BRAIN Initiative. The increase, focused in IOS, supports research on mapping circuits that drive behavior in a variety of organisms.
- I-Corps: BIO will slightly decrease support for I-Corps grants that test the feasibility of commercial prototypes developed from NSF/BIO-supported research (a total of \$1.0 million, \$900,000 below the FY 2014 Estimate).
- In FY 2015, BIO will participate in the NSF-wide activity, Improving Undergraduate STEM Education (IUSE), which supports the agency's investments in undergraduate education. BIO will continue to fund research and development through its undergraduate programs and the Partnership for Undergraduate Life Science Education (PULSE) program, leading to and propagating interventions that improve both the quality and quantity of STEM graduates. For more information regarding IUSE and NSF's undergraduate framework, see the IUSE narrative in the NSF-Wide Investments chapter. Funding totals \$2.50 million.
- In FY 2015 BIO will participate in the NSF-wide activity, NSF Research Traineeship (NRT) program, which is a modernization of the Integrative Education and Research Traineeship (IGERT) program. For more information regarding NRT, see the Major Investments in Science, Technology, Engineering, and Mathematics (STEM) Graduate Education narrative in the NSF-Wide Investments chapter.
- Science, Engineering, and Education for Sustainability (SEES): BIO will sustain support for the Dimensions of Biodiversity and Coupled Natural & Human Systems (CNH) components, while phasing down support for other SEES programs (-\$10.0 million below the FY 2014 Estimate, to a total of \$21.0 million).

BIO Funding for Centers Programs and Facilities

BIO Funding for Centers Programs

(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over FY 2014 Estimate	
				Amount	Percent
Total, Centers Programs	\$44.52	\$42.76	\$38.91	-\$3.84	-9.0%
Centers for Analysis & Synthesis	31.21	21.36	20.80	-0.56	-2.6%
Nanoscale Science & Engineering Centers	2.22	6.33	6.33	-	-
Science & Technology Centers	9.09	13.32	10.16	-3.16	-23.8%
Science of Learning Centers	2.00	1.75	1.63	-0.12	-6.9%

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 decreases by \$560,000 below the FY 2014 Estimate, to a total of \$20.80 million. The program will support three centers in FY 2015. The decreased support represents the planned phase-down of the Plant Science Cyberinfrastructure Collaborative (iPlant) and the sunset of the National Evolutionary Synthesis Center (NESCent) in FY 2014.
- Nanoscale Science and Engineering Centers (NSEC): Support will be continued for the Centers for Environmental Implications of Nanotechnology (CEIN).
- Science and Technology Centers (STCs): BIO will maintain support for three STCs in FY 2015 for a total of \$10.16 million. Funding for two centers will decrease. The Science and Technology Center for Microbial Oceanography Research and Education (C-MORE) decreases \$660,000 below the FY 2014 Estimate, to a total of \$3.32 million, as it begins a planned FY 2015 sunset, and the Bio/computational Evolution in Action CONSortium (BEACON) decreases to a total of \$2.50 million (-\$2.50 million below the FY 2014 Estimate) as it enters a fifth year of funding. Support is initiated for the new Center for Biology with X-Ray Lasers (X-Fel).
- Science of Learning Centers: FY 2015 is the final year of support for SLCs. BIO funding decreases by \$125,000 below the FY 2014 Estimate to \$1.63 million total.

BIO Funding for Facilities

(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over FY 2014 Estimate	
				Amount	Percent
Total, Facilities	\$1.56	\$26.35	\$43.35	\$17.00	64.5%
Nanofabrication (NNIN)	0.35	0.35	0.35	-	-
Cornell High Energy Synchrotron Source (CHESS)	-	5.00	5.00	-	-
National Ecological Observatory Network (NEON)	1.21	21.00	38.00	17.00	81.0%

Totals may not add due to rounding.

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

- Funding for NEON operations and management (O&M) ramps up in FY 2015 (+\$17.0 million over the FY 2014 Estimate, to a total of \$38.0 million) as sites are commissioned and validated for delivery of science data through a central cyberinfrastructure portal. NEON is in its fifth year of construction and is building a series of 106 sites over twenty domains across the U.S.
- Cornell High Energy Synchrotron Source (CHESS): Support for CHESS will be sustained. It is an important synchrotron facility for studying biological molecules, for training beam-line scientists, and for research in non-traditional areas such as the analysis of works of art. The facility also has an outreach program targeting Native American students.

Summary and Funding Profile

In FY 2015, the number of full research grant proposals is projected to increase slightly compared to FY 2014 estimated submissions. BIO will continue with the current proposal submission process: a preliminary proposal step was implemented in two of four divisions in BIO in FY 2012, and three divisions moved to annual full proposal cycles in FY 2013. Pre-proposals are not counted in the numbers cited in the funding profile below. Numbers of total proposals submitted, including both pre-proposals and full proposals, has not changed appreciably. BIO expects to award about 920 research grants. Average annual award size and duration will be sustained.

In FY 2015, BIO will invest \$38.91 million in centers, accounting for 5.5 percent of the BIO budget. In FY 2015, total centers funding will decrease from the FY 2014 Estimate, as the Center for Microbial Oceanography Research and Education (C-MORE) and Science of Learning Centers will have begun planned sunsets.

Operations and maintenance funding for BIO-supported facilities comprise 6.2 percent of BIO's FY 2015 Request.

BIO Funding Profile

	FY 2013	FY 2014	FY 2015
	Actual	Estimate	Estimate
	Estimate	Estimate	Estimate
Statistics for Competitive Awards:			
Number of Proposals	5,937	6,085	6,235
Number of New Awards	1,253	1,330	1,310
Funding Rate	21%	22%	21%
Statistics for Research Grants:			
Number of Research Grant Proposals	4,851	4,970	5,094
Number of Research Grants	879	930	920
Funding Rate	18%	19%	18%
Median Annualized Award Size	\$182,254	\$185,000	\$185,000
Average Annualized Award Size	\$228,530	\$235,000	\$235,000
Average Award Duration, in years	3.3	3.3	3.3

Program Monitoring and Evaluation

Committee of Visitors (COV):

- In FY 2013, BIO held COVs for Plant Genome Research Program (PGRP) and the Division of Biological Infrastructure (DBI). The DBI COV recommended increasing assessment efforts for Broader Impacts throughout DBI’s programs and splitting the DBI COV into two parts – one to evaluate core programs and one to evaluate oversight and management of centers. The COV for PGRP recommended an action plan to deal with the amount of data being generated and the need for data integration across species and research groups.
- In FY 2014, a COV will review Emerging Frontiers, focusing on two programs, Macrosystems and Advancing Digitization of Biodiversity Collections (ADBC). Two additional COVs will focus on the core programs of the Division of Molecular and Cellular Biosciences (MCB) and the Division of Integrative Organismal Systems (IOS).
- In FY 2015, a COV will review the Division of Environmental Biology (DEB).

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 being provided to the COV members for their assessment and recommendations.

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 was received in FY 2013.
- IOS is planning a workshop for the summer of 2014 on the future of Animal Behavior programmatic areas focused on integration. A final report will be received in FY 2015.
- DEB funded a series of workshops in 2012 and 2013 through an award titled “Frontiers in Ecosystem Science: Energizing the Research Agenda,” to catalyze the Ecosystem Science community to develop an agenda of major directions for future research with a focus on interdisciplinary topics. A final report is expected in FY 2014.

- DEB, MCB, and the division of Chemical, Bioengineering, Environmental, and Transport Systems (CBET) within the Directorate for Engineering jointly supported an award titled “Creating a Research Agenda for the Ecological Implications of Synthetic Biology,” which supports workshops to set a national research agenda for environmental implications of synthetic biology. The workshops were conducted in Jan-Feb 2014 and a final report is expected in FY 2014.
- The Long Term Ecological Research (LTER) program in DEB funded a “Task Force to re-envision the network office of the Long Term Ecological Research Program.” In FY 2013, this award supported a team of researchers to engage diverse environmental science communities in discussions about, and to gather input on, the future structure and function of the Long Term Ecological Research Network Office. A preliminary report is due in 2014. The group’s final report will help to inform future directions of the network office and the LTER network.
- MCB, CBET, and the division of Chemistry (CHE) within the Directorate for Mathematical and Physical Sciences jointly supported an award for a preliminary study by Board on Life Sciences of the National Academies on Enabling Architecture for the Next Generation of Life Sciences Research. A report will be available in FY 2014.
- MCB and CBET jointly supported an award for a preliminary study on “Industrialization of Biology: A Roadmap to Accelerate Advanced Manufacturing of Chemicals.” The National Research Council of the National Academy of Sciences, through its Board on Chemical Sciences and Technology and its Board on Life Sciences, will identify key gaps in knowledge, tools, techniques and systems needed to realize the potential for advanced manufacturing via biological systems, using manufacturing of chemicals as the case study. A report will be available in FY 2014.

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 2013		
	Actual Estimate	FY 2014 Estimate	FY 2015 Estimate
Senior Researchers	4,421	4,700	4,600
Other Professionals	1,651	1,800	1,700
Postdoctorates	1,416	1,500	1,500
Graduate Students	2,778	2,900	2,900
Undergraduate Students	4,431	4,700	4,600
Total Number of People	14,697	15,600	15,300

DIVISION OF MOLECULAR AND CELLULAR BIOSCIENCES (MCB) \$128,580,000
-\$1,100,000 / -0.9%

MCB Funding
(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over FY 2014 Estimate	
				Amount	Percent
Total, MCB	\$123.40	\$129.68	\$128.58	-\$1.10	-0.85%
Research	122.56	128.21	126.84	-1.37	-1.1%
CAREER	14.94	14.53	14.71	0.18	1.2%
Education	0.84	1.48	1.74	0.26	17.7%

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 interdisciplinary research projects that integrate theory, methods, and technologies from physical sciences, mathematics, computational sciences, and engineering to address major biological questions. Using this approach, MCB seeks to fund research that addresses the emerging areas of synthetic biology, multi-scale integration, molecular and cellular evolution, and quantitative prediction of phenome from genomic information.

The division also supports 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 one can 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 additional 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, 41 percent of the MCB portfolio is available for new research grants and the remaining 59 percent funds continuing grants made in previous years.

FY 2015 Summary

All funding decreases/increases represent change over the FY 2014 Estimate.

Research

- Emphasizing support for multidisciplinary biological research in MCB will yield insights that can be used to produce the next generation of nano-, bio-, and information technologies.
- MCB will maintain its support for BioMaPS (total of \$1.67 million) through partnership with MPS and ENG. Support will 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 support CEMMSS research via BioMaPS and the National Nanotechnology Initiative (NNI), (-\$250,000, to a total of \$4.5 million) 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. MCB will invest in catalytic funds for opportunities for MCB-funded researchers to connect with industry.

- Support for early-career researchers is a BIO priority; MCB will increase investment (+\$180,000 million, to a total of \$14.71 million) in CAREER grants.

Education

- Along with other BIO divisions, MCB increases support for Research Experiences for Undergraduates (REU) activities (+\$262,000 to a total of \$1.71 million).

DIVISION OF INTEGRATIVE ORGANISMAL SYSTEMS (IOS)

\$218,190,000
+\$2,450,000 / 1.1%

IOS Funding
(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over	
				FY 2014 Estimate Amount	Percent
Total, IOS	\$204.50	\$215.74	\$218.19	\$2.45	1.1%
Research	187.89	185.48	187.60	2.12	1.1%
CAREER	10.38	9.39	9.50	0.11	1.2%
Education	2.64	6.06	6.39	0.33	5.4%
Infrastructure	13.97	24.20	24.20	-	-

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. Activities supported by IOS focus on neural, developmental, physiological, and behavioral processes that affect organismal 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.

Within IOS, support for neuroscience focuses on the basic functions of the nervous system in response to physical, physiological, and social environments; a major emphasis is on the neuronal mechanisms that underlie organismal responses and adaptation to an ever-changing biosphere. Supported research includes comparative and evolutionary approaches to better understand how organisms perceive their environment, transduce that information in the nervous system, and respond appropriately, at multiple levels of analysis. Approaches are empirical, theoretical, computational, and trans-disciplinary.

The Plant Genome Research Program (PGRP) supports genome-scale research to accelerate basic discoveries of relevance 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 plant 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 solutions to problems of agriculture in developing countries.

In general, 43 percent of the IOS portfolio is available for new research grants and the remaining 57 percent funds continuing grants made in previous years.

FY 2015 Summary

All funding increases represent change over the FY 2014 Estimate.

Research

- IOS supports neuroscience research directed towards the study of biological mechanisms responsible for complex brain functions, such as those that provide the basis for adaptive responses to changing environments and those that drive the evolution of animal behavior. In FY 2015, IOS will increase funding for Cognitive Science and Neuroscience (+\$4.50 million, to a total of \$9.50 million).
- IOS core programs will support research related to the Five Grand Challenges, with emphases on maintaining a balanced award portfolio and broadening participation. In order to support this activity, IOS programs across all areas other than Cognitive Science and Neuroscience will have slight decreases.
- Support for early-career researchers is a BIO priority; IOS will increase investment (+\$110,000, to a total of \$9.50 million) in CAREER grants.

Education

- Along with other BIO divisions, IOS increases support for Research Experiences for Undergraduates (REU) activities (+\$330,000 to a total of \$2.14 million).
- 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).

Infrastructure

- The IOS request includes investments in research resources essential to PGRP, including tools for high-throughput analysis of agriculturally-important plant phenotypes under field conditions, as well as computational tools for assembly and annotation of large, complex crop plant genomes and integration of these with associated genomic data.

DIVISION OF ENVIRONMENTAL BIOLOGY (DEB)

\$137,520,000
-\$1,350,000 / -1.0%

DEB Funding
(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over	
				FY 2014 Estimate	FY 2014 Estimate
Total, DEB	\$133.26	\$138.87	\$137.52	-\$1.35	-1.0%
Research	131.45	137.11	135.49	-1.62	-1.2%
CAREER	7.54	3.92	3.97	0.05	1.3%
Education	1.81	1.76	2.03	0.27	15.3%

Totals may not add due to rounding.

DEB supports research to inventory and document life on earth, to discover life’s origins and evolutionary history, to understand the dynamics of ecological and evolutionary systems, and to understand feedback between natural and human systems. Scientific foci in DEB 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. DEB research is enhanced by interactions with the fields of genomics, computer science, geoscience, engineering, and mathematics.

In general, 70 percent of the DEB portfolio is available for new research grants. The remaining 30 percent funds continuing grants made in previous years.

FY 2015 Summary

All funding decreases/increases represent change over the FY 2014 Estimate.

Research

- In DEB, support decreases slightly (-\$1.35 million) for fundamental research. DEB supports a focus on addressing the Five Grand Challenges at the interface of life and physical sciences, including 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 Dimensions of Biodiversity and Coupled Natural Human Systems (CNH) will be sustained in DEB.
- Support for early-career researchers is a BIO priority; DEB will increase investment (+\$50,000, to a total of \$3.97 million) in CAREER grants.
- DEB will sustain its FY 2014 investment (total of \$2.0 million) in planning and pilot activities to advance our understanding of life’s legacy and future on Earth, in conjunction with a new program on the genealogy of life (GoLife). 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

- Along with other BIO divisions, DEB increases support for Research Experiences for Undergraduates (REU) activities (+\$272,000 to a total of \$1.78 million).

DIVISION OF BIOLOGICAL INFRASTRUCTURE (DBI)

\$136,670,000
+\$4,340,000 / 3.3%

DBI Funding
(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over	
				FY 2014 Estimate Amount	Percent
Total, DBI	\$121.16	\$132.33	\$136.67	\$4.34	3.3%
Research	52.31	51.67	47.19	-4.48	-8.7%
CAREER	5.50	5.93	6.00	0.07	1.2%
Centers Funding (total)	44.52	42.76	38.91	-3.85	-9.0%
Centers for Analysis & Synthesis	31.21	21.36	20.80	-0.56	-2.6%
Nanoscale Science & Engineering Centers	2.22	6.33	6.33	-	-
STC: Center for Microbial Oceanography (C-MORE)	4.00	3.32	2.66	-0.66	-19.9%
STC: BEACON	5.09	5.00	2.50	-2.50	-50.0%
STC: Xfel	-	5.00	5.00	-	-
Science of Learning Centers	2.00	1.75	1.63	-0.13	-7.1%
Education	21.09	19.90	19.50	-0.40	-2.0%
Infrastructure	47.76	60.77	69.98	9.21	15.2%
NNIN	0.35	0.35	0.35	-	-
CHES	-	5.00	5.00	-	-
Research Resources	47.41	55.42	64.63	9.21	16.6%

Totals may not add due to rounding.

DBI empowers biological discovery by supporting the development and enhancement of biological research resources, human capital, centers, and facilities. 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, center-like activities, and a few small facilities creates opportunities to address targeted but deep biological questions that have major societal impact.

In general, 56 percent of the DBI portfolio is available for new research grants and 44 percent funds continuing grants made in previous years.

FY 2015 Summary

All funding decreases/increases represent change over the FY 2014 Estimate.

Research

- DBI is responsible for managing most infrastructure, research resources, and center activities. This portfolio totals \$47.19 million in FY 2015.

Directorate for Biological Sciences

- Support for two STCs decreases. The Center for Microbial Oceanography Research and Education (C-MORE) begins a planned sunset with final funding in FY 2015; the Bio/computational Evolution in Action CONSortium (BEACON) decreases as it enters a fifth year of funding. Support for a Science of Learning Center also decreases as this activity sunsets in FY 2015.
- Support for early-career researchers is a BIO priority; DBI will increase investment (+\$70,000, to a total of \$6.0 million) in CAREER grants.

Education

- Along with other BIO divisions, DBI increases support for Research Experiences for Undergraduates (REU) activities (+\$223,000 to a total of \$11.09 million).
- Support for IGERT will decrease by \$650,000, to a total of \$2.60 million, as continuing grants are finalized.
- Support for NRT will increase by \$30,000, to a total of \$710,000.

Infrastructure

- \$10.0 million in funding for ADBC will transfer into DBI from EF. The program was fostered in EF during development of strategic and implementation plans.
- DBI support for CIF21 is sustained at \$6.50 million and 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).
- Two facilities will receive sustained funding: the Cornell High Energy Synchrotron Source (CHESS) and National Nanotechnology Infrastructure Network (NNIN).

DIVISION OF EMERGING FRONTIERS (EF)

\$87,560,000
-\$17,090,000 / -16.3%

EF Funding
(Dollars in Millions)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over	
				FY 2014 Estimate Amount	Percent
Total, EF	\$96.90	\$104.65	\$87.56	-\$17.09	-16.3%
Research	78.83	70.65	46.56	-24.09	-34.1%
CAREER	1.75	1.75	1.75	-	-
Education	6.23	2.55	2.55	-	-
Infrastructure	11.83	31.45	38.45	7.00	22.3%
Research Resources	10.62	10.45	0.45	-10.00	-95.7%
National Ecological Observatory Network	1.21	21.00	38.00	17.00	81.0%

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. Examples include the SEES and Advanced Digitization of Biodiversity Collections (ADBC) programs, which are 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, 86 percent of the EF portfolio is available for new research grants. The remaining 14 percent funds continuing grants made in previous years.

FY 2015 Summary

All funding decreases/increases represent change over the FY 2014 Estimate.

Research

- EF decreases by \$24.09 million as research programs scale down in order to increase support for operations and maintenance (O&M) for NEON. Previously, BIO set aside funding for NEON O&M through the establishment of a series of short-term programs with the anticipation of phase-down to occur simultaneously with the phase-in of NEON O&M.
- Support for SEES programs will be reduced by \$10.0 million, including phase-out of support for ocean acidification, SEES fellows, and Sustainability Research Networks (SRNs). Support will continue for CNH and Dimensions of Biodiversity.
- Support for Macrosystems will be reduced by \$10.0 million.
- CAREER support is maintained at \$1.75 million.
- Support for INSPIRE decreases by \$1.0 million, to a total of \$1.0 million.

Directorate for Biological Sciences

- Support for BioMaPS will be sustained at \$12.64 million. In FY 2015, the research focus is expanded to include increasingly essential understanding of environmental impacts, evolutionary consequences, and societal acceptance of synthetic biology products and organisms.
- Support for innovation programs continue with support for new cross-BIO activities, IDEAS Labs, and interdisciplinary research.

Education

- In FY 2015, BIO will support the NSF-wide Improving Undergraduate STEM Education (IUSE) activity (\$2.50 million).

Infrastructure

- \$10.0 million in funding for ADBC will transfer from EF into DBI, where it will be supported as a core activity. The program was fostered in EF during development of strategic and implementation plans.
- Funding for NEON O&M will increase by \$17.0 million, to a total of \$38.0 million.