

INTERNATIONAL POLAR YEAR

The International Polar Year (IPY) in 2007-2009 will mark the 50th anniversary of the International Geophysical Year (IGY) 1957-58, in which unparalleled exploration of Earth and space led to discoveries in many fields of science that have forever changed the way we view the polar regions and their global significance. Countries around the world are now actively planning their IPY activities, and the International Council for Science (ICSU) and the World Meteorological Organization (WMO) are working to provide project integration where appropriate.

In FY 2008, NSF will continue funding IPY research, infrastructure, and education. NSF's approach addresses the challenges posed by the U.S. National Academies of Science (NAS) in its vision document for IPY. The approach addresses guidance on federal R&D investments (i.e., that investments sustain agency missions through stewardship of user facilities, enhance the Nation's ability to understand and respond to global environmental issues, and strengthen international partnerships that foster advancement of scientific frontiers). It supports the goals of the American Competitiveness Initiative (ACI) by contributing to and stimulating an array of learning opportunities for citizens of all ages by linking our activities to those in other countries.

IPY provides a framework and impetus to undertake research projects that normally could not be achieved by any single nation. It allows thinking beyond traditional boundaries – whether national borders or disciplinary constraints – toward a new level of integrated cooperative science linked to education and outreach efforts. More than 25 nations have formally declared their intent to participate, and many more are sure to follow. NSF will use IPY to strengthen existing international relationships and forge new connections to address the broad and interlinked research challenges faced by all participating nations.

The vision for IPY established by the NAS includes an "... intense, coordinated campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation.... that will benefit society by exploring new frontiers and increasing understanding of the key roles of the polar regions in globally linked systems."

As the lead agency supporting polar research, NSF will provide U.S. leadership in IPY through the work of its grantees, in coordination with other agencies, and by developing partnerships with other nations. In FY 2006, emphasis was placed on establishing an Arctic Observing System in support of the Study of Environmental ARctic CHange (SEARCH), on Polar Ice Sheet Dynamics and Stability, and on studies of Life in the Cold and Dark, particularly at the genomic level. Work in FY 2007 and FY 2008 builds on these themes and expands to new ones identified in research community planning activities.

One major NSF IPY focus will be on climate change research and environmental observations. Much of the research supported under IPY will be consistent with and supportive of the goals of the U.S. Climate Change Science Program, particularly Goal 1, "Extend knowledge of the Earth's past and present climate and environment, including its natural variability, and improve understanding of the causes of observed changes," and Goal 2, "Improve understanding of the forces bringing about changes in the Earth's climate and related systems." Work will include observations, data, analysis, models, and natural and social science research to strengthen our ability to understand and respond to global environmental issues. Climate change research and environmental observations are highlighted as an R&D priority under "Environment." An important NSF IPY focus associated with climate change will be on Humans in the Arctic. In most instances, U.S. scientists' efforts will be leveraged by the related efforts of international scientists.

Another major focus will be on the interagency FY 2008 R&D priority, “Understanding Complex Biological Systems,” through research that enables advances in understanding how life adapts and survives the polar dark, with emphasis on the cellular and genomic levels but reaching to human impacts as well. Using new biological tools and generating increasing amounts of genetic sequence data and information, this work will pave the way for new discoveries about the functional implications of gene expression.

A third focus of IPY will be maintaining existing standardized data sets, creating new scientific collections, and ensuring their availability to current and future generations of researchers. These will help frame the answers to current and as yet unknown questions. Led by NSF’s Office of Polar Programs (OPP), several of NSF’s disciplinary-based research directorates, NSF’s Directorate for Education and Human Resources, and the Office of International Science and Engineering will participate actively in this work. IPY provides an ideal opportunity to involve students in international research ventures.

IPY will also involve people of all ages, from all walks of life, and from diverse backgrounds – from teachers to students and artists to scientists – engaging them in the scientific discoveries that will evolve from this international, collaborative research venture. Teacher enhancement programs will increase the number of qualified math and science teachers. Through education and outreach, the importance of science and engineering in understanding earth systems will be showcased.

International Polar Year Funding

NSF funding for IPY activities in FY 2007 and FY 2008 will be administered by OPP in collaboration with other NSF offices and directorates. These will build on a number of ongoing NSF programs throughout the agency and the OPP core investments designed to facilitate world leadership in this worldwide activity. NSF’s IPY FY 2008 request totals \$58.67 million.

IPY investments will address the challenges in research, education, and outreach posed by the National Academies. It will also provide funding for polar logistics and infrastructure that will make IPY research possible. NSF’s investments will improve the infrastructure for research at the Long Term Ecological Research sites at Toolik Lake, Alaska, in the Antarctic Dry Valleys, as well as at the Barrow, Alaska, Global Climate Change Research Facility, and at NSF’s research station in Summit, Greenland. These improvements will enable fundamental research in biology and ecology into the polar winter months.

NSF directorates and offices will also support a broad range of smaller innovative projects from ongoing programs that respond to the NAS/NRC guidelines.

International Polar Year Funding
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over	
				FY 2007 Request Amount	Percent
Biological Sciences (BIO)	-	\$2.00	\$2.00	-	-
Geosciences (GEO)	-	5.00	5.00	-	-
Office of International Science & Engineering (OISE)	-	0.30	0.40	0.10	33.3%
Office of Polar Programs (OPP)	10.00	47.27	47.27	-	-
Social, Behavioral and Economic Sciences (SBE)	2.40	5.00	2.00	-3.00	-60.0%
Subtotal, Research and Related Activities (R&RA)	12.40	59.57	56.67	-2.90	-4.9%
Education and Human Resources (EHR)	2.95	2.00	2.00	-	-
Total, IPY Funding	\$15.35	\$61.57	\$58.67	-\$2.90	-4.7%

FY 2008 Areas of Emphasis:

BIO will 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.

GEO will focus on climate modeling that couples polar ocean currents, climate, and sea ice extent to phenomena observed or predicted in mid-latitudes. Research activities associated with the Integrated Ocean Drilling Program are planned in the Arctic. Both Arctic and Antarctic observations of the polar upper atmosphere will be emphasized in order to better understand space weather. This research will use the new Advanced Modular Incoherent Scatter Radar in Alaska and at Resolute Bay, Canada.

OISE will partner with other NSF research directorates and offices through the agency-wide focused program and with foreign research organizations to catalyze international collaborations on polar research in support of IPY.

OPP will support a special-focused competition for IPY as well as a broad range of individual innovative projects that respond to the ICSU and NAS/NRC guidelines. In particular OPP will: 1) fund a significant component of the Arctic Observing Network, leveraging observing system investments made by international partners, such as the European Union; 2) provide funding to allow key observations in lesser-known sectors of the Antarctic Ice Sheet, thus allowing incorporation of these data into developing mathematical models of ice sheet dynamics; 3) provide funds for genomics in polar biology, and to increase work to exploit genetic and molecular biology approaches toward understanding how organisms and ecosystems have adapted to the extreme conditions of the Antarctic; 4) support, in collaboration with EHR, activities in informal and formal education to raise public awareness of the importance of the polar regions to understanding our changing planet; 5) initiate, with SBE, a new focus on Humans in the Arctic; and 6) provide essential logistics and infrastructure improvements needed to implement activities planned for IPY.

SBE will support research on human adaptation and change within polar environments that focus on human-environment interactions from a range of perspectives. Human adaptations reflected in native languages and cultures will be documented. Furthermore, social and economic aspects of nutrition, mental well-being, and infectious diseases will also be examined. Although SBE is reducing its participation by \$3.0 million, it will continue to augment its IPY investments through related core

activities. Through its "gold-standard" General Social Survey (GSS), SBE provided specific questions in 2006 that addressed Americans' knowledge of the polar regions. SBE plans to continue this series of questions so as to provide longitudinal data on this topic.

EHR supports coordination and communication for IPY education projects. These will support formal science education experiences for K-12 teachers and undergraduate and graduate students, and informal science education for the broader public.

In all these activities, NSF will provide funds for the collection and maintenance of legacy information using cutting-edge data management methods and shared access to the data products resulting from IPY activities. Each will be linked to NSF's education and outreach IPY goals and will be implemented with international collaborators. A concerted effort will also be made to:

- Engage the public in polar discovery through informal science education projects such as museum exhibits, large format films and television and radio documentaries. These will leverage the inherent appeal of the polar regions to inspire and educate diverse audiences of all ages in polar scientific research and the relevance of the polar regions to the earth system; and
- Attract and develop the next generation of scientists and engineers through hands-on field experiences in polar research. K-12 educators, and graduate and undergraduate students will be included as members of polar science teams. Teachers will be enabled to bring polar research to their classrooms to inspire the interest of the next generation of scientists in international, collaborative research about the polar regions.

Recent Research Highlight

► **Collapsing ice shelf reveals seafloor life:** Researchers have discovered an entirely unexpected ecosystem in the lightless depths just off the coast of the Antarctic Peninsula. When the Larsen B Ice Shelf collapsed there in 2002, it suddenly revealed the seabed beneath, giving NSF-supported scientists a chance to survey the contents. They found marine life forms, such as thick bacterial mats, that were able to subsist without sunlight – which had been blocked by the ice above – and therefore without photosynthesis.



View of basal glacial debris (marginal moraine of Robertson Island Ice Cap) on top of Cretaceous outcrop on Cape Marsh, Robertson Island. View in background of grounded tabular icebergs from penultimate collapse of Larsen B ice shelf, coastal meltwater plumes and R/V *Nathaniel B. Palmer*. Picture taken December, 2001. Credit: *Eugene Domack*.

Such communities, called “chemotrophic” because their members obtain energy from oxidation of chemical compounds rather than deriving it from sunshine, had previously been seen only at warm volcanic locations and hydrothermal vent areas on the sea floor. Eugene Domack of Hamilton College and colleagues described their findings in publications during 2005. The scientists speculate that the bacteria may feed on seepage of methane gas from the seabed. The research also serves to further

understanding of how ice shelves collapse, as well as providing insight into potential sea level change associated with global warming.



View of remnant tabular iceberg (from Larsen B) in front of the new fjord coast of Oscar II Land (taken February, 2005). *Credit: David Tewksbury.*

