

## INTERNATIONAL POLAR YEAR

The International Polar Year (IPY) in 2007-2008 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.

The U.S. National Academies of Science (NAS) developed broad goals and objectives for U.S. IPY activities and the White House Office of Science and Technology Policy tasked NSF with serving as the lead federal agency for implementing IPY 2007-2008. A further source of information on U.S. IPY activities can be found at [www.US-IPY.org](http://www.US-IPY.org). The U.S. vision developed by and articulated in the NAS/National Research Council (NRC) document, *A Vision for the International Polar Year 2007-2008*, urges the U.S. scientific community and agencies to participate as leaders in IPY and to address five broad scientific challenges:

- Assessing large-scale environmental change in the polar regions, with questions looking at both the physical and human dimensions of change and its impacts;
- Conducting scientific exploration of “new” frontiers, whether these are once inaccessible places such as the seafloor, or areas of inquiry that are now open because of advances in technology, such as how genomics tools now allow investigation of previously unanswerable questions about biological adaptation;
- Observing the polar regions in depth, with adequate coverage of the vast and challenging landscape, to provide a description of current conditions and allow for better future understanding of variability and change;
- Understanding human-environmental dynamics in a region where the connections are intimate and where the impacts of change are clear; and
- Creating new connections between science and the public, building on the inherently intriguing character of these regions.

NSF’s approach to IPY addresses the challenges posed by the Academies’ vision publication and is consistent with the Administration’s 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) while contributing to and stimulating an array of learning opportunities for citizens of all ages in linking our activities to those in other countries.

IPY will provide a framework and impetus to undertake research projects that normally could not be achieved by any single nation. It allows us to think 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.

Once underway, IPY will involve people of all ages, from all walks of life, and from diverse backgrounds — from teachers to students and artists to scientists. It is NSF’s responsibility to reach out and build awareness of the scientific discoveries that will evolve from this international, collaborative research venture. In keeping with this vision, NSF has outlined its own set of goals for the conduct of

internationally coordinated research and education that will be visible to the public through extensive outreach efforts.

**FY 2007 Areas of Emphasis:**

Proposed IPY investments and activities support focuses on three research areas — **Study of Environmental ARctic CHange (SEARCH); Polar Ice Sheet Dynamics and Stability; and Life in the Cold and Dark** — that will advance fundamental scientific discovery to improve future quality of life and enhance our ability to understand and respond to global environmental issues. Further, the structure of IPY — requiring international collaborations — specifically responds to the goal to strengthen international partnerships that foster advancement of scientific frontiers and accelerate the progress of science across borders. Additionally, the proposed infrastructure investments to support IPY, such as investing in NOAA’s Barrow Global Change Climate Research Facility and Antarctic surface traverse vehicles, are critical to NSF’s missions and to support the missions of other agencies through stewardship of user facilities. Plans for IPY are multi-agency and interagency, and the three broad research areas mentioned above tie directly to two Administration priorities, Understanding Complex Biological Systems and Energy and Environment.

**International Polar Year Funding**

NSF funding for IPY activities will consist of commitments from a number of ongoing NSF programs throughout the agency that will build on the Office of Polar Programs (OPP) core investments designed to facilitate world leadership in this worldwide activity. NSF’s IPY FY 2007 request totals \$61.57 million. It is estimated similar amounts will be requested in FY 2008.

IPY investments for FY 2007 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. The investments will be administered by OPP in collaboration with other NSF offices and directorates and will focus initially on advancing the frontiers of knowledge in the three previously mentioned broad areas: 1) **SEARCH**, 2) **Polar Ice Sheet Dynamics and Stability**; and 3) **Life in the Cold and Dark**.

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 2007 Request
Biological Sciences (BIO)	\$2.00
Geosciences (GEO)	5.00
Office of International Science and Engineering (OISE)	0.30
Office of Polar Programs (OPP)	47.27
Social, Behavioral and Economic Sciences (SBE)	5.00
Subtotal, Research and Related Activities (R&RA)	59.57
Education and Human Resources (EHR)	2.00
<b>Total, IPY Funding</b>	<b>\$61.57</b>

BIO will continue support for environmental genomics, including research in support of IPY activities related to **Life in the Cold and Dark**. A special focus will be the evolutionary ecology of infectious diseases with relevance to the effects of climate change in polar environments.

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 during FY 2007. Both Arctic and Antarctic observations of the polar upper atmosphere will be emphasized in order to better understand space weather, especially those using the new Advanced Modular Incoherent Scatter Radar in Alaska and at Resolute Bay, Canada.

OISE will partner with other NSF research directorates and offices and with foreign research organizations to catalyze international collaborations on polar research in support of IPY.

OPP will support a special competition for IPY as well as a broad range of smaller innovative projects that are responsive 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 West Antarctic Ice Sheet, and thus allow incorporation of these data into developing mathematical models of ice sheet dynamics; 3) provide funds for genomics in polar biology, 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; and 4) provide essential logistics and infrastructure improvements needed to implement activities planned for IPY.

SBE plans to support interdisciplinary research on human adaptation and change within polar environments that focuses on human/environment interactions from a range of perspectives, including physical anthropology and cognitive neuroscience, sociology and geo-political relations, and economics, as well as science and technology studies. These areas are applicable to **SEARCH** and **Life in the Cold and Dark**.

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

In all these activities NSF will collect and maintain legacy information using cutting-edge data management methods and provide 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 diverse audiences of all ages and to educate them about 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 for K-12 educators and graduate and undergraduate students as members of polar science teams, and prepare and inspire teachers to bring polar research to their classrooms and stimulate the interest of the next generation of scientists in international, collaborative research about the polar regions.

### **Recent Research Highlights**

► **Penguins change ... and stay the same:** When it is time to breed each year, a penguin typically returns to the same site where it was born. So it is logical to suppose that each separate colony would eventually develop its own distinctive genetic makeup.

But new studies using fossil DNA samples recovered from breeding sites show exactly the opposite. When NSF-supported researchers and their New Zealand colleagues compared the genes of present penguins to those from 6000 years ago, they found that the population as a whole has evolved. Yet they found no genetic differences between sites, even when the colonies were separated by thousands of kilometers.

Why? Recent events offer clues. Grounding of a large iceberg changed the geography of the ice, lengthening some foraging trips and blocking access to some colonies. Instead of returning to their natal sites, penguins migrated to other rookeries to mate and nest, thereby promoting genetic mixing. Such changes in ice conditions are not unusual, and may represent a longstanding evolutionary force.



Adelie penguin with chicks. *Photo credit: Emily Stone, the Antarctic Sun.*