

# The POLAR RESEARCH BOARD

*Looking Back*

*Looking Ahead*

**A 60<sup>th</sup> Anniversary  
Compendium**

*The National Academies of*  
SCIENCES • ENGINEERING • MEDICINE



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# Message from the PRB Director



The 60th anniversary presents an opportunity to look back on the important legacy of the Polar Research Board. I am honored and humbled to be at the helm of an organization with such a long history of distinguished service to the polar community.

The International Geophysical Year (IGY) in 1957-1958 brought nations around the world together to study the natural world. The IGY efforts in Antarctica were particularly exciting, creating enthusiasm in the United States and abroad to learn more about the largely unexplored continent. Drawing upon the growing interest in both poles, the National Academy of Sciences founded the Polar Research Committee in 1958. Later renamed the Polar Research Board, it has provided a focal point for the polar community ever since.

One of the most wonderful parts of taking the time to reflect on our history is learning more about all the impressive people who have come together over the decades to contribute their time and energy to this incredible legacy. From Larry Gould, the Board's first chair, who traveled to Antarctica for the dedication of the Amundsen-Scott IGY South Pole Station, to Julie Brigham-Grette, the current chair, who traveled to Anchorage, Alaska to address the top diplomats of Arctic nations, our history is full of remarkable individuals.

The Polar Research Board has produced countless reports that have helped inform our understanding of the Arctic, Antarctic, and other cold regions of the planet. In its early days, the board identified research priorities for fieldwork in Antarctica, selected scientists to conduct the research, and even helped to coordinate logistics for these expeditions. As the National Science Foundation and other federal agencies built their polar programs and capacity, the Board continued to provide guidance for research priorities, while also helping to synthesize scientific insights.

An anniversary is also a great opportunity to look ahead at what is still to come. Scientific understanding of the polar regions is becoming more important than ever as human influence on the environment is most keenly felt there. So much remains to be learned about these remote parts of the planet, even as they are undergoing rapid change. Addressing these challenges requires bringing together the multidisciplinary polar research community, connecting with the broader science community, and making our insights relevant to the nation and the world. The Polar Research Board is poised to continue bringing the polar community together around our curiosity about these magnificent regions of the Earth, and our deep concern for how these regions are changing and are connected to all of us.

As we take a moment to look back at the last 60 years, we also look forward to the many ways that the Polar Research Board can continue to serve the polar research community, the nation, and the world.

**AMANDA STAUDT, PHD**

*The polar regions are captivating expanses, teeming with life and beauty. Far from being frozen wastelands at the ends of Earth, the poles significantly affect humans and the environment worldwide.*

**T**he Polar Research Board (PRB) of the National Academies of Sciences, Engineering, and Medicine is dedicated to enhancing understanding of the Arctic, the Antarctic, and the world's cold regions. Now celebrating its 60th year, PRB has a long history of distinguished service to the polar community.

PRB's mission is to promote excellence in polar science and to provide independent guidance to federal agencies, Congress, and the nation on issues at the intersection of science and policy. Activities of PRB strive to make research in the polar regions more productive and responsive to the needs of the United States, to maintain awareness of and representation in international science programs, and to bring together the expertise needed to address specific concerns.

PRB serves in many different ways. The Board has produced dozens of reports, workshop summaries, and other publications on topics ranging from climate change to national security to the conduct of research at the poles. PRB regularly provides a venue for the polar community to come together to explore issues and identify priorities through its regular Board meetings, workshops, and other convening activities.

The work of PRB is more important than ever as science and technology have advanced and as access to the polar regions has increased. The impacts of climate change are magnified at the poles, which brings urgency to the study of its rapidly changing environments.



*From a scientific perspective, the polar regions offer unique opportunities to advance understanding of Earth and its inhabitants.*

### Learning How Life Adapts to Extremes

The climate of the polar regions would be lethal to most organisms on Earth, but life has found ways to adapt. How do hibernating mammals survive freezing body temperatures during a long polar winter? How does the blood of polar fish remain in the liquid state at sub-zero temperatures? Advances in genetics can help us gain insights that could support advancements in human health, agricultural, industrial, and other applications.



### Understanding Climate Changes to Come

The polar regions are on the front-line of environmental change, for instance with climate warming twice as fast in the Arctic than in most of the rest of the world. There is a critical need to better understand the processes driving melting of the massive ice sheets covering Greenland and Antarctica, since knowing how much ice will be lost, and over what timescales, will tell us how much sea level rise will affect coastal regions around the world.

### Discovering New Frontiers

It was not until the 1970s that researchers learned there is liquid water at the base of the Antarctic ice sheet, several kilometers beneath the surface. Using both airborne and surface radar, researchers have now identified more than 145 subglacial lakes. The microbial communities, sediments, and underlying rock in the lakes present a rich source of ongoing research.

### Polar Connection to Space

The dry, stable atmosphere above the South Pole offers an ideal environment for astrophysical research—for instance, on cosmic microwave background radiation, solar, cosmic ray, and neutrino physics—that helps us understand the evolution and structure of the universe. Both the Arctic and the Antarctic provide critical platforms for studying how solar magnetic storms drive “space weather” and in turn affect Earth’s magnetic field and upper atmosphere. This research helps reduce the risks posed by space weather on the satellites, communications systems, and power grids upon which society relies.



# A Strong Partner in the International Polar Community



The PRB's long history with SCAR includes providing a plaque for the 1959 signing of the Antarctic Treaty at the National Academy of Sciences building in Washington, D.C.

The premise of the very first International Polar Year (IPY), held in 1882-1883, was that the study of geophysical phenomena was of such magnitude that it could not be surveyed by one nation alone, but rather, would require a global effort. Twelve countries participated, and 15 expeditions to the poles were completed (13 to the Arctic, and 2 to the Antarctic). For the United States, it provided an opportunity to establish a scientific station at Point Barrow, the northernmost point in Alaska and the United States.

The spirit of international science cooperation established by the first IPY persists today, and PRB is an active participant. PRB serves as the U.S. National Committee to two organizations that play critical roles in convening and organizing international cooperation in polar research, and providing scientific input to international policy: the **Scientific Committee on Antarctic Research (SCAR)** and the **International Arctic Science Committee (IASC)**.

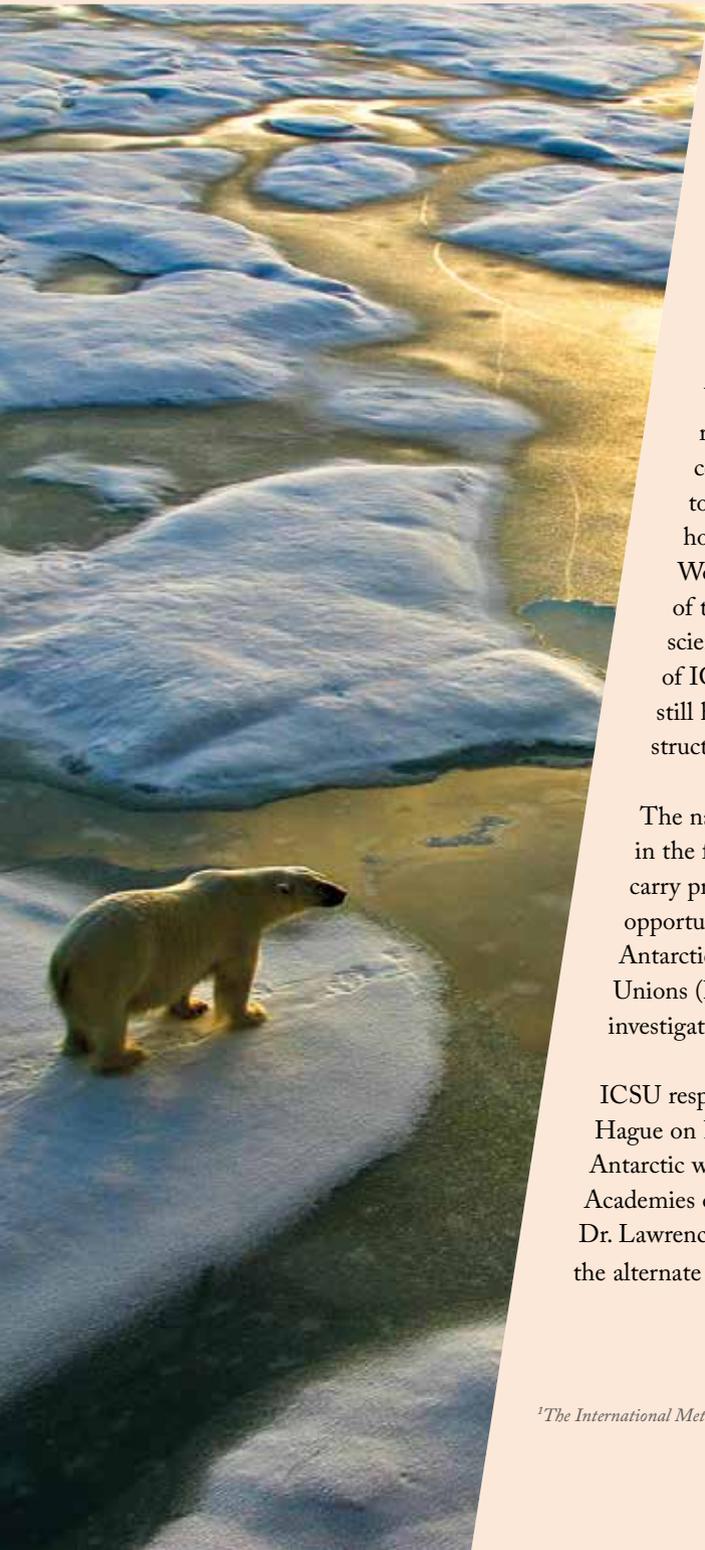
Established in 1958, SCAR is a nongovernmental organization charged to initiate, promote, and coordinate international scientific activity in the Antarctic. SCAR also provides scientific and technological advice to the consulting meetings of the Antarctic Treaty, which governs science activities of member nations in Antarctica, including the United States. In its role as U.S. National Committee, PRB is responsible for ensuring the U.S. Antarctic research community stays informed about—and is encouraged to actively participate in—SCAR activities. PRB also nominates and selects the U.S. Delegate and Alternate Delegate to SCAR, and representatives to SCAR's physical science, geosciences, and life sciences standing groups.

IASC was founded in 1990 by representatives of national scientific organizations in the eight Arctic countries. Over the years, IASC has evolved into the leading international science organization of the North, and its membership today includes 23 countries, including 15 non-Arctic countries. IASC is governed by a Council, composed of one representative of each of its member countries, which meets annually at the Arctic Science Summit Week. PRB is responsible for the selection of the U.S. Delegate, Alternate Delegate, and two members to each of the Working Groups, which provide the main forums for developing IASC scientific programs and activities.



At the IASC Arctic Science Summit Week, held in Fairbanks, Alaska in March 2016, the PRB organized a meeting with representatives of the U.S. Arctic Research Commission, the European Polar Board, Polar Knowledge Canada, the Asian Forum for Polar Sciences, and the Russian Academy of Sciences.

# How the PRB Came to Be: A Retrospective



The first IPY (1882-1883) drew together 12 nations to study the polar regions. The second IPY held in 1932-1933 and organized by the International Meteorological Organization,<sup>1</sup> drew 40 nations to investigate the global implications of the newly discovered “Jet Stream.” The effort established forty permanent observation stations in the Arctic. The United States contributed by sponsoring the second Byrd expedition in Antarctica, which established the first meteorological research station inland from Antarctica’s coast.

While these events cemented the importance of studying the polar regions, PRB would not get its start until the culmination of the successful International Geophysical Year (IGY), held from 1957 to 1958. The IGY was conceived by several eminent physicists who hoped to redirect the technology and scientific momentum from World War II efforts towards advances in research. Under the auspices of the IGY, 67 countries came together to study 11 chosen Earth sciences. Both the international cooperation and scientific achievements of IGY were seen as a decisive success, with several of its advancements still holding immense importance to today’s scientific and diplomatic structures.

The nations that had IGY programs in the Antarctic met in Stockholm in the fall of 1957 to complete the coordination and planning needed to carry programs to a successful conclusion. The attendees recognized the opportunity for continued international cooperation in scientific research in Antarctica and recommended that the International Council of Scientific Unions (ICSU) establish a committee to plan for the international scientific investigations in this region.

ICSU responded by establishing SCAR, which held its first meeting at the Hague on February 3-5, 1958. Each nation having IGY stations in the Antarctic was invited to send a delegate to this meeting. The National Academies of Sciences, as the adhering U.S. body of ICSU, nominated Dr. Lawrence M. Gould to be the U.S. delegate and Dr. Harry Wexler as the alternate delegate.

<sup>1</sup>The International Meteorological Organization was a predecessor to the World Meteorological Organization (WMO).

The SCAR gathering strongly recommended a continued international research program in the Antarctic, and several of the nations that had participated in IGY—including Australia, Belgium, Chile, the USSR, Argentina, New Zealand, Japan, France, Norway, and the United Kingdom, along with the United States—indicated their intentions to continue this research.

In response to the support from ICSU and a request from the National Science Foundation that the National Academy of Sciences (NAS) prepare an appropriate scientific program for a proposed international Arctic effort in 1959, the NAS established the **Committee on Polar Research**, the predecessor to the PRB, in February of 1958. Dr. Gould was appointed chairman and Mr. R.C. Peavy as Executive Secretary.

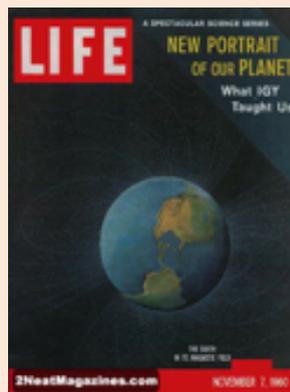
Detlev W. Bronk, president of the NAS, said in his letter of appointment to Committee members, that *“the conduct of research in the Arctic and Antarctic has become a matter of continuing concern to science, with a close and important relationship to the national welfare.”*

### CHARGE TO THE ORIGINAL COMMITTEE ON POLAR RESEARCH (ABRIDGED)

The National Academy of Sciences has established a Committee on Polar Research whose functions are: (i) to develop programs of research in the Antarctic and Arctic for 1959 following the termination of the International Geophysical Year and (ii) to plan the long-range research objectives and annual observational programs of the United States in these regions.

In carrying out these responsibilities the Committee will work closely with the National Science Foundation and various public and private agencies.

By Academy representation in the Special Committee on Antarctic Research (SCAR) and its participation in SCAR activities, the Committee will continue to represent the interests of U.S. Antarctic scientists in scientific matters requiring international coordination and cooperation.



To mark the success of IGY, in November 1960, LIFE magazine introduced a four-part photojournalism series, *“The New Portrait of Our Planet, Great Discoveries of the IGY are revealed.”* The series’ presentation of complex science data in a visually dramatic form helped capture public interest in IGY.



# Board Chairs through History

*PRB appoints a group of experts to oversee the Board's activities, advise on pressing issues in the polar regions, and identify potential initiatives. Over its 60-year history, the Board has been led by a distinguished group of Chairs, each of whom have made many individual contributions to polar science and the polar community.*



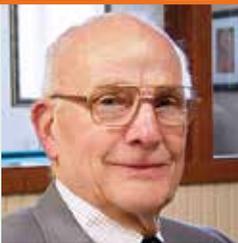
**DR. JULIE BRIGHAM-GRETTE**  
(2014—PRESENT)

Professor and chair of the Department of Geosciences, at the University of Massachusetts, Amherst



**DR. JAMES W.C. WHITE**  
(2008—2014)

Professor of Geological Sciences and Dean of Arts and Sciences at the University of Colorado at Boulder



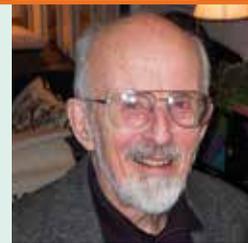
**DR. ROBERT H. RUTFORD**  
(1991—1994)

Professor of Geosciences at The University of Texas at Dallas



**DR. GUNTER E. WELLER**  
(1985—1990)

Professor of Geophysics Emeritus at the University of Alaska Fairbanks



**DR. CHARLES R. BENTLEY**  
(1981—1985)

Professor at the University of Wisconsin, Madison

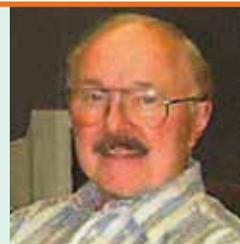




**DR. ROBIN BELL**  
(2002—2008)  
Professor at Columbia  
University's Lamont-Doherty  
Earth Observatory



**DR. DONAL T. MANAHAN**  
(1999—2002)  
Professor of Biological  
Sciences at The University of  
Southern California (USC)  
in Los Angeles



**DR. DAVID L. CLARK**  
(1995—1998)  
Professor Emeritus of the  
University of Wisconsin,  
Madison



**DR. ALBERT LINCOLN WASHBURN**  
(1978—1981)  
Professor in Geology at the University  
of Washington and Director of the  
Quaternary Research Center



**DR. JAMES H. ZUMBERGE**  
(1973—1977)  
Professor at the Southern  
Methodist University



**DR. LAURENCE M. GOULD**  
(1958—1972)  
Professor at Carleton College



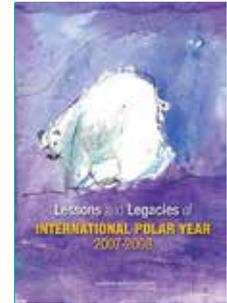
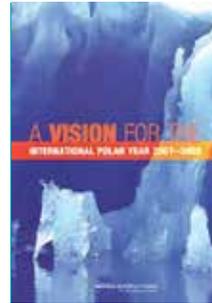
# PRB's Leadership in the International Polar Year 2007-2008

*“The International Polar Year is the scientific opportunity of a generation for our nation, for our society, and for our planet.”*

CHAIR ROBIN BELL

The many feats accomplished during IGY helped the public understand the value of bringing nations together to conduct scientific research. Nonetheless, it would be 50 years before an effort of the same scope took place again. The International Polar Year (IPY) 2007-2008 was one of the largest collaborative science programs ever attempted. More than 50,000 researchers, local residents, educators, students, and support personnel from 60 nations and numerous scientific disciplines conducted 228 projects. The effort's many accomplishments included the first high-resolution images of whole mountain ranges buried beneath the Antarctic ice sheet.

Under the leadership of Director, Chris Elfring and Chair, Robin Bell, PRB was instrumental in helping coordinate and launch IPY 2007-2008. The Board helped define what IPY should accomplish, hosting several information-gathering meetings, scientific sessions, and an interactive website.



PRB produced two reports in support of the effort. *A Vision for the IPY 2007-2008*, released in 2004, provided a framework for planning science activities in preparation for International Polar Year. *Lessons and Legacies of International Polar Year 2007-2008*, released in April 2012, assessed the effort's contributions to polar science and identified opportunities to build on these successes.

## CHRIS ELFRING: IN MEMORIAM

Chris Elfring served as the PRB Director from 1995 to 2013. A warm and caring leader, Chris's commitment to the mission of the Academies and to the polar community was inspirational. The PRB made some of its most important contributions under her leadership, most notably the superb leadership for the International Polar Year 2007-2008.

Chris's talents and contributions were widely recognized outside of the National Academies. The polar research community named a geographic feature in Antarctica "Elfring Peak" in her honor. In the climate community, she received a distinguished service award from the American Meteorological Society and was elected as one of its fellows.

The National Academies of Sciences, Engineering, and Medicine is indebted to Chris for her many contributions and outstanding service.



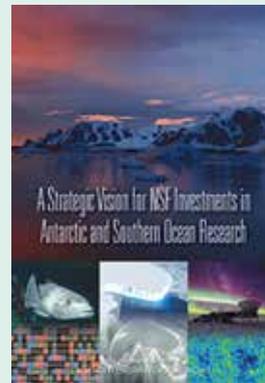
# PRB Reports and Activities

*Over the years, PRB has produced dozens of reports on issues related to the poles and cold regions. These included annual reports on the state of Antarctic research, which the Board issued from 1959 until 1991. In addition, as listed below, PRB provides consensus guidance and holds workshops on topics at the forefront of Arctic and Antarctic research.*

- Antarctic Sea Ice Variability in the Southern Ocean-Climate System: Proceedings of a Workshop (2017)
- A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research (2015)
- Arctic Matters: The Global Connection to Changes in the Arctic (2015)
- The Arctic in the Anthropocene: Emerging Research Questions (2014)
- Responding to Oil Spills in the U.S. Arctic Marine Environment (2014)
- Linkages Between Arctic Warming and Mid-Latitude Weather Patterns: Summary of a Workshop (2014)
- Opportunities to Use Remote Sensing in Understanding Permafrost and Related Ecological Characteristics: Report of a Workshop (2014)
- Seasonal to Decadal Predictions of Arctic Sea Ice: Challenges and Strategies (2012)
- Lessons and Legacies of International Polar Year 2007-2008 (2012)
- Future Science Opportunities in Antarctica and the Southern Ocean (2011)
- Frontiers in Understanding Climate Change and Polar Ecosystems: Summary of a Workshop (2011)
- Scientific Value of Arctic Sea Ice Imagery Derived Products (2009)
- Martha Muse Prize for Science and Policy in Antarctica: An International Polar Year Legacy (2008)
- Antarctica: A Keystone in a Changing World (2008)

## NSF CITES PRB REPORT IN CALL FOR PROPOSALS

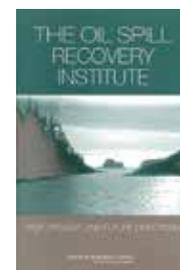
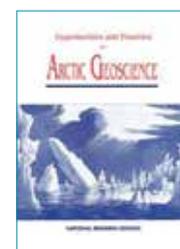
The National Science Foundation embraced the vision of the PRB report, *A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research*, as seen in this excerpt from a recent call for proposals:

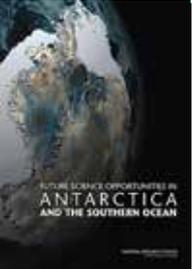
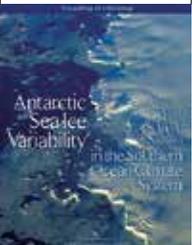
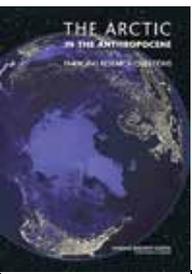


*"In FY2014, the Antarctic Sciences Section (ANT) of the Division of Polar Programs supported the NAS to consult broadly with the community and develop consensus recommendations for prioritizing NSF sponsored Antarctic research over the next decade. Their report was published in*

*2015 and is available online. This report followed an extensive review of the U.S. Antarctic Program that led to two prior reports, one on the science drivers for research over the next two decades and the other on the need for infrastructure modernization. This "Strategic Vision" report will be an important consideration for decisions by the Antarctic Sciences Section about future research proposals."*

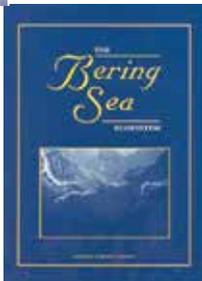
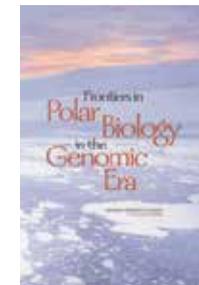
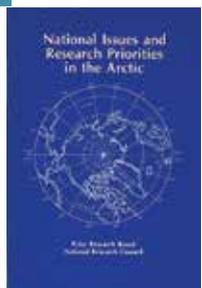
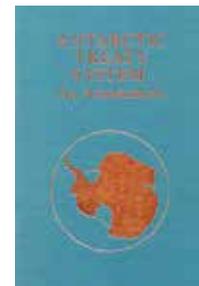
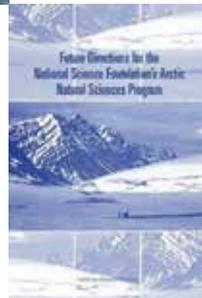
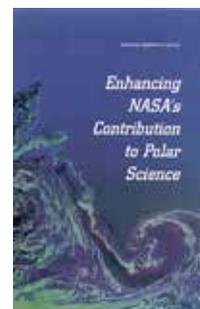
- Exploration of Antarctic Subglacial Aquatic Environments: Environmental and Scientific Stewardship (2007)
- Polar Icebreakers in a Changing World: An Assessment of U.S. Needs (2007)
- Toward an Integrated Arctic Observing Network (2006)
- Polar Icebreaker Roles and U.S. Future Needs: a Preliminary Assessment (2005)
- Review of the Draft Research and Restoration Plan for Arctic-Yukon-Kuskokwim Salmon (2005)
- Final Comments on the Science Plan for the North Pacific Research Board (2005)
- International Polar Year 2007-2008: Report of the Implementation Workshop (2005)
- A Vision for International Polar Year 2007-2008 (2004)
- Elements of a Science Plan for the North Pacific Research Board (2004)
- Frontiers in Polar Biology in the Genomic Era (2003)
- Cumulative Environmental Effects of Oil and Gas Development on Alaska's North Slope (2003)
- Oil Spill Recovery Institute: Past, Present, and Future Directions (2002)
- A Century of Ecosystem Science: Planning Long-term Research for the Gulf of Alaska (2002)
- Abrupt Climate Change: Inevitable Surprises (2002)
- Enhancing NASA's Contributions to Polar Science: A Review of Polar Geophysical Data Sets (2001)
- Ocean Drilling Research: An Arctic Perspective (1999)
- The Community Development Quota Program in Alaska and Lessons for the Western Pacific (1999)
- Future Directions for the NSF's Arctic Natural Sciences Program (1998)
- NOAA's Arctic Research Initiative: Proceedings of a Workshop (1997)
- The Bering Sea Ecosystem (1996)
- The Arctic Aeromedical Laboratory's Thyroid Function Study: A Radiological Risk and Ethical Analysis (1996)
- Arctic Ocean Research and Supporting Facilities: National Needs and Goals (1995)
- Arctic Contributions to Social Science and Public Policy (1993)
- Science and Stewardship in the Antarctic (1993)
- Opportunities and Priorities in Arctic Geoscience (1991)
- Prospects and Concerns for Satellite Remote Sensing of Snow and Ice (1989)
- Arctic Social Science: An Agenda for Action (1989)
- Atmospheric Observing Program in the Antarctic (1989)
- Long-term Glacier Monitoring in Alaska (1989)
- Physical Oceanography and Tracer Chemistry of the Southern Ocean (1988)
- Data Coordination and Career Stimulation in Polar Biomedical Research (1988)





- Priorities in Arctic Marine Science (1988)
- Quality of Science Support on Existing U.S. Coast Guard Icebreakers: Report of a Survey (1988)
- Evaluation of the U.S. Coast Guard's "Conceptual Design Document" and "Preliminary Design Document" for the Proposed Next Generation of Polar Class Icebreakers (1988)
- Antarctic Solid-Earth Sciences Research: A Guide for the Next Decade and Beyond (1986)
- Recommendations for a U.S. Ice Coring Program (1986)
- U.S. Research in Antarctica in 2000 A.D. and Beyond: A Preliminary Assessment (1986)
- Antarctic Treaty System: An Assessment [Proceedings of a Workshop Held at Beardmore South Field Camp, Antarctica, 7-13 January 1985] (1986)
- Glaciers, Ice Sheets, and Sea Level: Effects of a CO<sub>2</sub>-Induced Climatic Change: Report of a Workshop (1985)
- National Issues and Research Priorities in the Arctic (1985)
- Fourth International Conference on Permafrost, 17-22 July 1983, Fairbanks, Alaska: Final Proceedings (1984)
- The Polar Regions and Climatic Change, Appendix (1984)
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- Analysis of Deep Ice Cores from Greenland, Report of a Workshop (1984)
- Environment of West Antarctica: Potential CO<sub>2</sub>-Induced Changes Report of a Workshop (1984)
- Ice Segregation and Frost Heaving (1984)
- Permafrost Research: An Assessment of Future Needs (1983)
- Fourth International Conference on Permafrost, 17-22 July 1983, Fairbanks, Alaska: Proceedings, Committee on Permafrost (1983)
- Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluation and Recommendations, Appendix B: Components of an Arctic Terrestrial Environmental Research Program (1983)
- Snow and Ice Research: An Assessment (1983)
- Research Emphases for the U.S. Antarctic Program (1983)
- A United States Commitment to Arctic Research (1982)
- Polar Biomedical Research: An Assessment (1982)
- Polar Biomedical Research: An Assessment Appendix: Polar Medicine—A Literature Review (1982)
- Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluation and Recommendations (1982)

- Arctic Terrestrial Environmental Research Programs of the Office of Energy Research, Department of Energy: Evaluation and Recommendations Appendix A: Terrestrial Environmental Research in Alaska During 1980-1981 (1982)
- Study of the Upper Atmosphere and Near-Earth Space in Polar Regions: Scientific Status and Recommendations for Future Directions (1982)
- An Evaluation of Antarctic Marine Ecosystem Research (1981)
- Backgrounds, Guidelines, and Procedures for U.S. Participants in SCAR (1979)
- An Evaluation of Arctic Programs Supported by the National Science Foundation (1977)
- Problems and Priorities in Offshore Permafrost Research (1976)
- Glacier and Ice Sheet Sliding (1976)
- Scientific Plan for the Proposed Nansen Drift Station (1976)
- Opportunities for Permafrost-Related Research Associated with the Trans-Alaska Pipeline System (1975)
- U.S. Contribution to the Polar Experiment (POLEX): POLEX-GARP (North) (1974)
- U.S. Contribution to the Polar Experiment (POLEX): POLEX-GARP (South) (1974)
- Priorities for Basic Research on Permafrost (1974)
- Antarctic Geology and Solid-Earth Geophysics: Guidelines for U.S. Program Planning 1973-1983 (1974)
- A Program for Use of Automatic Stations in Upper-Atmosphere Physics Research in Antarctica (1974)
- Upper Atmosphere Physics Research in the Antarctic: Guidelines for U.S. Program Planning 1973-1983, (1974)
- Antarctic Glaciology: Guidelines for U.S. Program Planning 1973-1983 (1974)
- Southern Ocean Dynamics: A Strategy for Scientific Exploration 1973-1983 (1974)
- Review of the Five-Year Coordinated Plan for Arctic Research, Interagency Arctic Research Coordinating Committee (1974)
- Management of Polar Ice-Rock Cores (1973)
- Lexicon of Antarctic Stratigraphic Names (1972)
- Cold Regions Research and Engineering Laboratory (CRREL) (1972)
- Antarctic Research 1973-1983: Recommendations for Future Science Programs (1972)
- Biomedical and Behavioral Science Research in Antarctica (1971)
- Polar Research—A Survey (1970)
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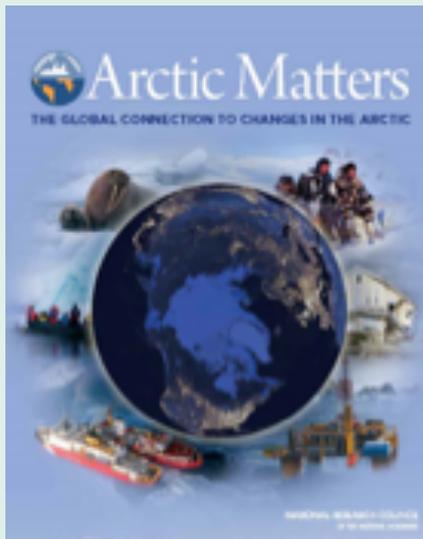


## ARCTIC MATTERS

In 2015, PRB launched *Arctic Matters*, a multifaceted effort to raise awareness of Arctic change and its many consequences across the globe. The outreach project was timed with the United States' Chairmanship of the Arctic Council, a forum to address issues faced by the eight Arctic nations and their indigenous populations.

The effort focused on a special public event, **Arctic Matters Day**, which drew an enthusiastic crowd of roughly 500 people in January 2016 to the National Academies' Kavli Auditorium in Washington, D.C. The event focused on examining how all of us both affect and are affected by the dramatic environmental changes happening in the Arctic region today.

The *Arctic Matters* outreach project produced an informational booklet, a classroom poster and an interactive website. The booklet became the primary resource used at the Global Leadership in the Arctic (GLACIER) conference, held in August 2015 and attended by President Barack Obama, Secretary of State John Kerry, and foreign ministers of over 20 countries. PRB Chair Julie Brigham-Grette was a featured speaker at the conference.



The *Arctic Matters* booklet was the primary resource used for many events during the U.S. Chairmanship of the Arctic Council from 2015-2017.

PRB Chair Julie Brigham-Grette was a featured speaker at the 2015 Glacier conference, pictured here with PRB members Larry Hinzman (left) and Rafe Pomerance (far right) and former senior advisor to President Barack Obama on science and technology issues, John Holdren (2nd from right).



# Looking Ahead...

*How will changes in glaciers, ice sheets, snow cover, and sea ice affect the global Earth system? How are traditional ways of life in the Arctic facing the challenges of a changing planet? What will be discovered when 21st century technology and new scientific monitoring and observational systems are placed in the service of science?*



Advancements in understanding processes and changes occurring in the Arctic and Antarctic have been facilitated by collaborative international efforts and rigorous exploration of pressing research questions. Looking to the future, continuing to ask informed questions, along with utilization of new approaches and technologies, is expected to expand our knowledge of these unique regions.

Science can best explore new realms and understand new global connections if the right technology exists to support it. The last 60 years have brought a quantum leap in the power of the tools of science – observing technology, computing capacity, miniaturization, and a host of other advances. We can do things now that would have been read about only in science fiction novels during IGY. Side-looking radar, ice thickness imaging radar, and upward sounding sonar provide precise profiles of mountain ranges, ice sheets, and sea ice thickness. Genomic-level analyses are accelerating our ability to discover and utilize novel traits of organisms found only in the polar regions. Climate models continue to advance to help us understand how significant environmental changes in the polar regions affect, and are affected by, global-scale changes.

But technology itself will not be sufficient. Addressing these challenges also will require new channels for coordination and innovation. Research in the polar regions has long brought experts from different disciplines, cultures, and nations together. This foundation of collaboration must continue to be a cornerstone of polar research as we tackle the challenges of the 21st century.

Looking ahead, PRB will continue to bring the polar research community together to identify new frontiers, guide new research endeavors, synthesize our expanding base of knowledge, and help the nation and the world understand and navigate our changing poles.

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