

S u s t a i n i n g

A P u b l i c R e s o u r c e ,
A P u b l i c T r u s t

*Fifth Annual
Roger Revelle Commemorative Lecture*

National Academy of Sciences Auditorium, Washington, DC

November **5**, 2003

5:00 pm

O u r O c e a n s



SUSTAINING

OUR OCEANS

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The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Wm. A. Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. Wm. A. Wulf respectively are chair and vice chair of the National Research Council.



Dear Lecture Participant:

On behalf of the Ocean Studies Board (OSB) of the National Academies, I would like to welcome you to the Fourth Annual Roger Revelle Commemorative Lecture.

For almost half a century, Roger Revelle was a leader in the field of oceanography. Revelle trained as a geologist at Pomona College and at U.C. Berkeley. Then, in 1936, he received his Ph.D. in oceanography from the Scripps Institution of Oceanography. As a young naval officer, he helped persuade the Navy to create the Office of Naval Research (ONR) to support basic research in oceanography and was the first head of ONR's geophysics branch. Revelle served for 12 years as the Director of Scripps (1950-1961, 1963-1964), where he built up a fleet of research ships and initiated a decade of expeditions to the deep Pacific that challenged existing geological theory.



DR. ROGER REVELLE
(1909 — 1991)

Revelle's early work on the carbon cycle suggested that the sea could not absorb all the carbon dioxide released from burning fossil fuels. He facilitated the first continual measurements of atmospheric carbon dioxide, leading to a long-term record that makes present-day discussions and research on global warming possible and very valuable. Revelle kept the issue of increasing carbon dioxide levels before the public and spear-headed efforts to investigate the mechanisms and consequences of climate change.

Revelle was a proponent of daring programs, like Mohole and the International Indian Ocean Expedition. This expedition addressed fundamental scientific questions and pioneered international cooperation. In 1960, Revelle left Scripps for critical posts as Science Advisor to the Department of the Interior (1961-1963) and as the first Director of the Center for Population Studies at Harvard (1964-1976). Revelle applied his knowledge of geophysics, ocean resources, and population dynamics to the world's most vexing problems: poverty, malnutrition, security, and education.

In 1957, Revelle became a member of the National Academy of Sciences (NAS) to which he devoted many hours of volunteer service. He served as a member of the Ocean Studies Board, the Board on Atmospheric Sciences and Climate, and many committees. He also chaired a number of influential Academy studies on subjects ranging from the environmental effects of radiation to understanding sea-level change.

This lecture was created by the Ocean Studies Board in honor of Dr. Roger Revelle to highlight the important links between ocean sciences and public policy.

I hope you enjoy the lecture.

Nancy Rabalais
Chair, Ocean Studies Board

OCEAN STUDIES BOARD

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ADMIRAL JAMES D. WATKINS
Chair, U.S. Commission on Ocean Policy

Admiral James D. Watkins, U.S. Navy (retired), is currently serving as chairman of the U.S. Commission on Ocean Policy. The Commission, authorized by Congress in the Oceans Act of 2000, includes 16 members appointed by the President. The Commission's task is to recommend a new, comprehensive national ocean policy to the Congress and the President in 2003.

Prior to his appointment to the Ocean Commission, Admiral Watkins served as president of the Joint Oceanographic Institutions (JOI), in Washington, D.C., from September 1993 until October 2000. In September 1994, Admiral Watkins led the historic effort to establish an expanded partnership among the more than 60 U.S. marine institutions. The effort resulted in a public-private corporation known as the Consortium for Oceanographic Research and Education, or CORE. In September 1996, as a result of CORE's efforts, Congress authorized and funded the National Oceanographic Partnership Act which implemented a new, broad ocean science and technology agenda for the nation. Admiral Watkins served seven years as founding President of CORE, stepping down in March 2001.

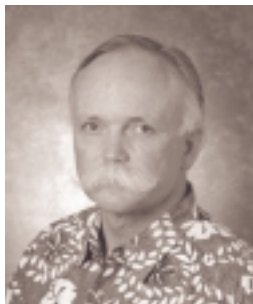
For his work with JOI and CORE, Admiral Watkins was awarded honorary doctor of science degrees from the College of William and Mary and Oregon State University in 1999. In March 2001, he was given the title of President Emeritus of CORE, and was awarded the Navy's Distinguished Public Service Award by the Secretary of the Navy for his contributions to the nation in ocean science and technology matters.

Prior to his oceanographic work, Admiral Watkins served as the sixth Secretary of Energy under President George H. Bush, from March 1989 through January 1993. He also served as the 22nd Chief of Naval Operations under President Ronald Reagan. Admiral Watkins is a native of California and a 1949 graduate of the U.S. Naval Academy.



Previous Revelle Lectures

2002 - BEYOND THE FREEDOM OF THE SEAS: OCEAN POLICY FOR THE THIRD MILLENNIUM



MICHAEL K. ORBACH
*Director, Duke University
Marine Laboratory*

ABSTRACT: Up until the end of the first millenium anno Domini humans used the oceans primarily at their margins, lacking the desire or the ability to venture further out to sea. In the second millenium humans exploded in their exploration of the seas, crossing, charting and beginning to exploit the spaces and resources of most of the world's oceans, at least to the depth of a few hundred fathoms.

In the last half of this second millenium, the formal doctrine of mare liberum, “freedom of the seas”, emerged under which most uses of the world’s oceans remained unregulated within any common community except for the constraints of individual nation states upon their own citizens. This “freedom of the seas” doctrine emerged for a very practical reason: No single nation or group of nations could effectively either monitor or control activities on the oceans except within fairly close proximity to land, and thus the “freedom” approach emerged as the negotiated compromise. Incursions have been made into this “freedom”, notably in the 200-mile extensions of jurisdiction among coastal nations in the 1970s and 80s and in such proposals as the Common Heritage of Mankind approach to ocean resources advanced during the United Nations Law of the Sea negotiations. However, most of the world’s oceans still remain in a state of “freedom” as an unregulated commons.

This “freedom” has had tragic consequences for many of the living marine resources and for water quality and habitat of the world’s oceans as well as promoting unnecessary competition and conflict over ocean space and resources. We now have the technological capability to monitor and, if we wish, control human activities virtually anywhere on the world’s ocean. This presentation will present alternative futures for the governance of the world’s oceans and their resources, “beyond the freedom of the seas” and into the third millenium.

2001—OCEAN EXPLORATION



DR. MARCIA K. MCNUTT
President and CEO
Monterey Bay Aquarium
Research Institute

ABSTRACT: The ocean is essential to life on Earth: it is Earth's largest living space and contains most of its biomass. The ocean moderates climate to keep Earth habitable, recycles our wastes, and provides an inexpensive source of protein to feed the global population. Yet 95 percent of the ocean remains unknown and unexplored. Now, thanks to a number of technological innovations, we have the tools necessary to undertake a systematic exploration of the ocean. Autonomous vehicles can be programmed to execute precise underwater surveys lasting up to weeks without pause. Remotely operated vehicles equipped with physical, chemical, and biological sensors function as our eyes, ears, noses, and hands in the deep sea. New data management systems permit the systematic archiving of information, allowing subsequent generations of researchers around the world to answer questions not contemplated at the time the data were collected.

Much has been learned about the oceans through traditional research programs. But research is different from exploration. While research attempts to find answers, exploration inevitably uncovers new questions. Ocean exploration brings great, but often unpredictable, rewards: cures for diseases from novel biological compounds, untapped mineral, energy, and biological resources, new insight into how the ocean functions, geological and biological vistas of unsurpassed beauty, and renewed appreciation for mankind's maritime past. The time is ripe to launch a major international program of ocean exploration with all the benefits it will bring.



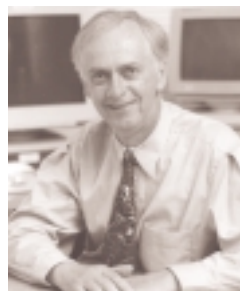
DR. SHIRLEY A. POMPONI

*Director, Division of
Biomedical Marine Research
Harbor Branch
Oceanographic Institution*

2000—THE OCEANS AND HUMAN HEALTH: THE DISCOVERY AND DEVELOPMENT OF MARINE-DERIVED DRUGS

ABSTRACT: The oceans are a rich source of both biological and chemical diversity. During the past two decades, thousands of novel marine-derived biochemicals have been identified. Many have the potential for development as new pharmaceuticals to treat diseases such as cancer and drug-resistant infections. The challenges facing continued discovery are both technical, such as developing new tools to explore habitats and collect and test organisms never before studied, as well as political, such as complying with regulations related to the rights of a country to its natural resources. Successful discovery and development of marine-derived pharmaceuticals will depend on our ability to address a number of questions. What organism produces the bioactive compound, and why? Can we apply this knowledge to our rapidly increasing understanding of the human genome and human disease processes? Are

there viable alternatives to harvesting for sustainable use of marine natural resources for drug development? And finally, what constitutes a fair and equitable sharing of revenues resulting from commercialization of marine resources, as mandated by the U.N. Convention on Biological Diversity? Addressing these questions will require the collaboration of marine and biomedical scientists and the cooperation of industry and government.



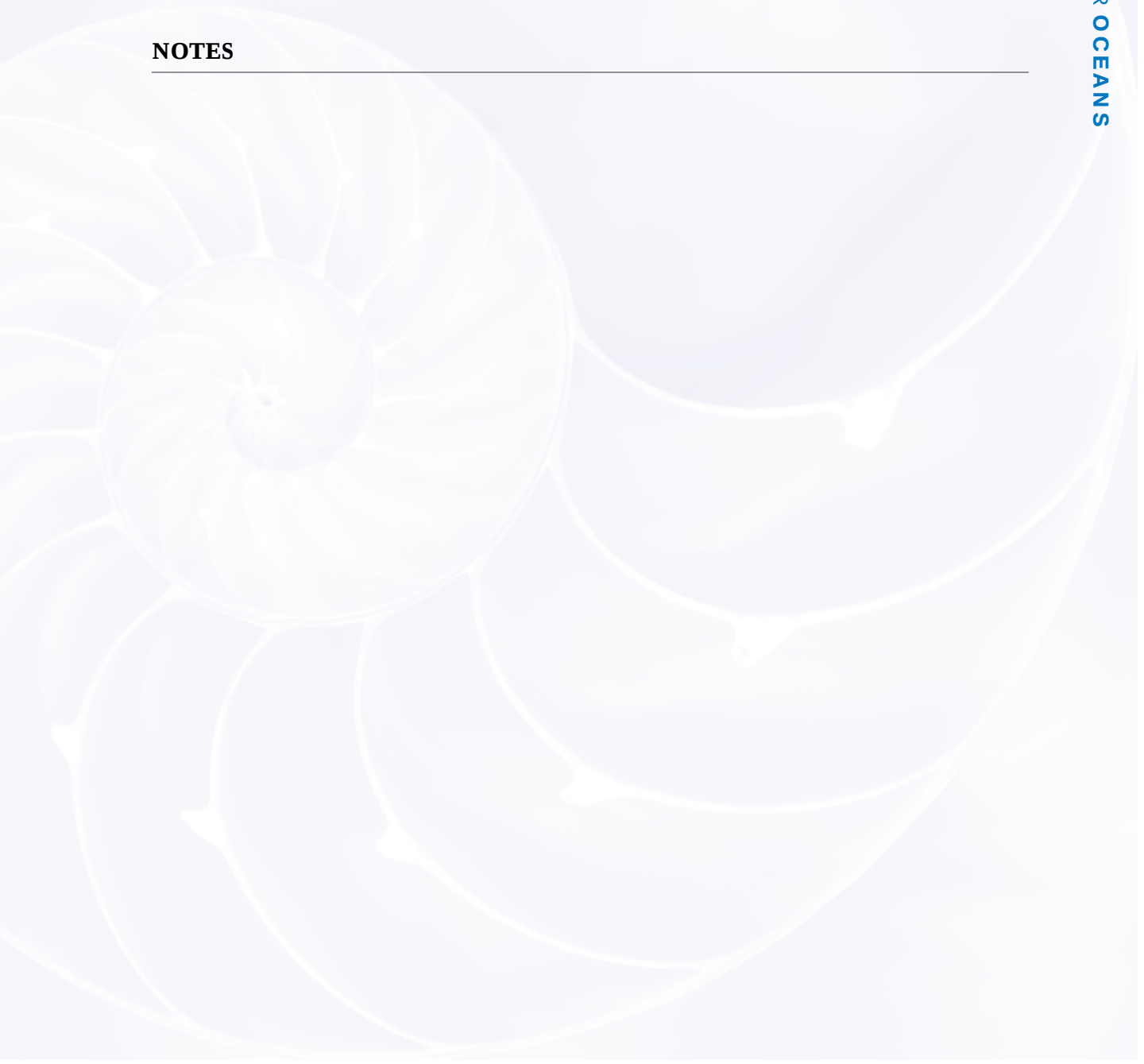
DR. PETER BREWER

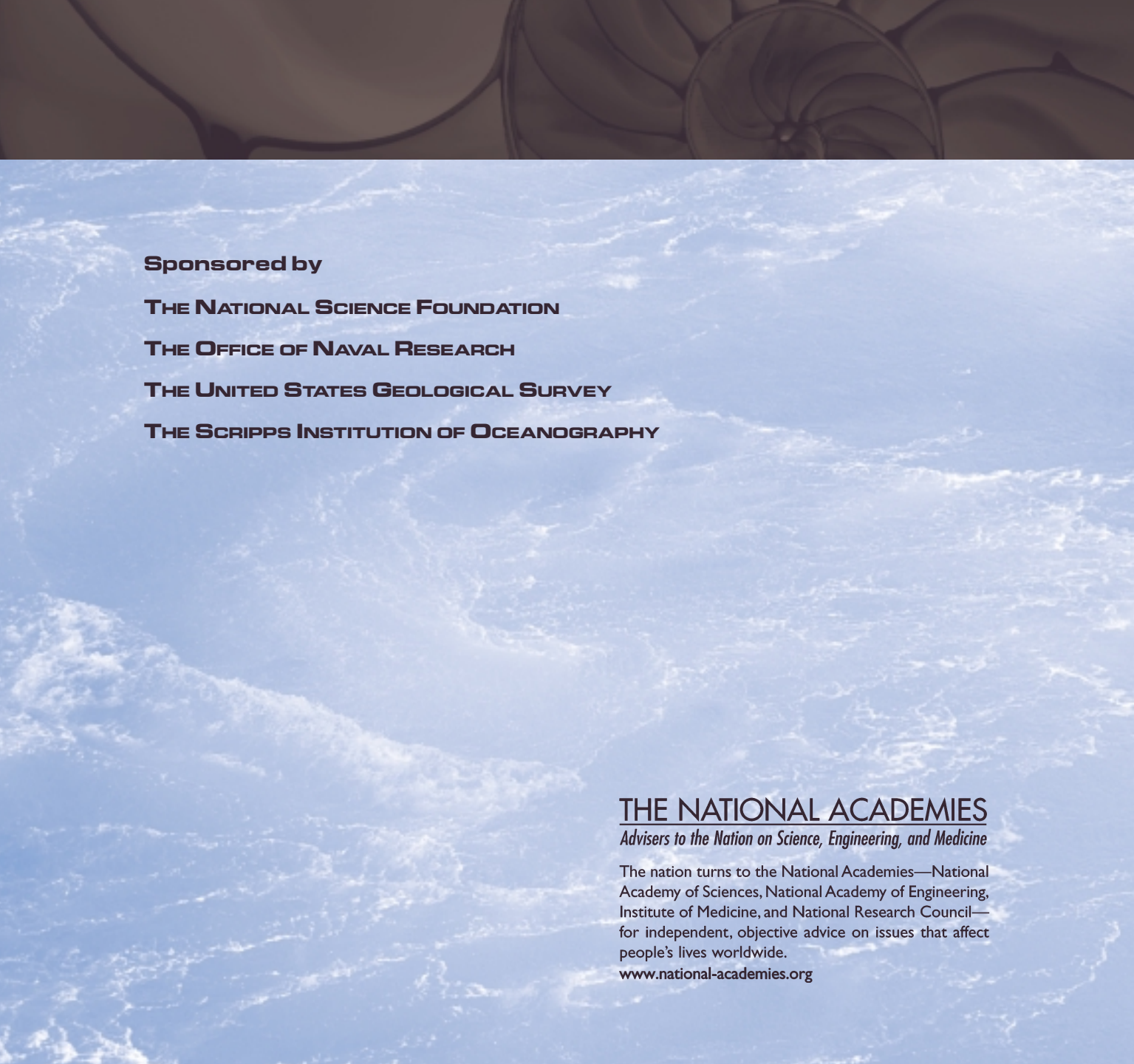
*Senior Scientist
Monterey Bay Aquarium
Research Institute*

1999—CONTEMPLATING ACTION: STORING CARBON DIOXIDE IN THE OCEAN

ABSTRACT: Concerns about global climate change suggest that we should level off, or even decrease, atmospheric carbon dioxide. Recent advances in ocean science hint at the possibility of taking active steps to achieve this. Experiments have shown that it is possible to inject carbon dioxide directly into the deep ocean, where it forms a solid gas hydrate. Other options have also been explored, such as fertilizing seawater to speed up the growth of microscopic plants that consume carbon dioxide. If we want to hold carbon dioxide levels steady, large interventions will be necessary. Is this even possible? And would there be unforeseen environmental consequences? Forty-two years after Roger Revelle's analysis of the "greenhouse" problem, society may be ready to take action through active use of the enormous buffering capacity of the ocean.

NOTES





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