GLOBAL CLIMATE CHANGE

AN EAST ROOM ROUNDTABLE

The White House

July 24, 1997

Proceedings

INTRODUCTION BY THE VICE PRESIDENT:

On behalf of the President and the First Lady, it is my pleasure and honor to welcome all of you to the White House.

Today we hear about the concerns of scientists. This Administration has always worked on the simple principle that science must inform policy decisions. Scientists are by nature a cautious group, but the world's scientific community is clearly telling us that they believe we are disrupting the balance of the world's climate. In the words of the 2,000 scientists who participated in the Intergovernmental Panel on Climate Change (IPCC), there is "a discernible human influence on global climate." Moreover, recently more than 2,600 scientists signed a letter about global climatic disruption that we'll be hearing more about later.

> *"Scientists are by nature a cautious group, but the world's scientific community is clearly telling us that they believe we are disrupting the balance of the world's climate."*
>
> **— Vice President Al Gore**

And now I would like to introduce the person who is leading our country, and the world, toward recognition of what must be done to deal with this issue. It is my honor, ladies and gentlemen, to present the President of the United States, President Bill Clinton.

THE PRESIDENT: Thank you very much. The whole issue of climate change must be looked at in terms of our deepest obligations to future generations. I have spent most of my time in the last 4½ years trying to prepare the American people for a new century and a new millennium. We must also protect the Earth for that new millennium, to ensure that the American people will benefit from the opportunities we are trying to create. We cannot fulfill our responsibilities to future generations unless we deal responsibly with the challenge of climate change.

The overwhelming balance of evidence and scientific opinion is that it is no longer a theory, but a fact, that global warming is for real. The world's scientists believe that if we don't cut our emissions of greenhouse gases, we will disrupt the global climate.

> *"We have the evidence, we see the train coming, but most ordinary Americans in their day-to-day lives can't hear the whistle blowing"*
>
> **— President Bill Clinton**

In the face of this, the United States must confront a challenge that in some ways is the most difficult of all democracy's challenges. We have the evidence, we see the train coming, but most ordinary Americans in their day-to-day lives can't hear the whistle blowing. Unless they have lived in a place where they have experienced severe and completely atypical weather in the last five years or so, the degree of the challenge is inconsistent with the actual perceived experience of most ordinary Americans.

A democracy is premised on the proposition that, if the American people or any people in any democracy know what the facts are and believe them, way more than half the time they will do the right thing. So what we are doing today is beginning a process in which we ask the American people to listen to the evidence, to measure it against their own experience, but not to discount the weight of scientific authority if their own experience does not yet confirm what the overwhelming percentage of scientists believes to be fact today.

I do want to say that I am convinced that, when the nations of the world meet in Kyoto, Japan, in December on this issue, the United States has got to be committed to realistic and binding limits on our emissions of greenhouse gases. Between now and then we have to work with the American people to get them to share that commitment. We have to emphasize flexible, market-based approaches. We have to embrace research and development efforts in technology that will help us to improve the environment while permitting our economy to grow. We have to ask all nations, both industrial and developing, to participate in this process. If we do this together, we can defuse this threat, and we can make the 21st century what it ought to be, not only for our children, but for all the children of the world.

I believe the science demands that we face this challenge now. I'm positive that we owe it to our children. And I hope that we can find the wisdom and the skill to do democracy's work in the next few months to build the consensus necessary to actually make action, as opposed to rhetoric, possible. To all of you, for your commitment to that, I thank you.

And now I'd like to ask Dr. Rowland to be the first of our distinguished scientists to lead off.

DR. ROWLAND: Mr. President and Mr. Vice President, global climatic change is underway. Carbon dioxide from the combustion of coal, oil, and natural gas has risen 15 percent in the atmosphere since 1958. Methane, some of which is emitted from cattle and rice paddies, has increased 16 percent since 1978. The air now holds four times as much chlorofluorocarbons as it did 25 years ago. The amount of ozone in the stratosphere over the United States is 6 to 10 percent lower than it was in the 1960s.

> *"Mr. President and Mr. Vice President, global climatic change is underway."*
>
> — F. Sherwood Rowland

Many other changes are occurring as well. The global average surface temperature has risen about 1 °F during the past century, and sea level has risen from 4 to 10 inches.

Land use patterns have been greatly altered as forests are burned for use as agricultural land. Many of the species formerly in these forests are disappearing. The geographical ranges of tropical diseases are moving northward. Human activities are the chief cause of many of these changes. The last century saw tremendous growth in the global population, from about 1½ billion in 1900 to 6 billion in the year 2,000 and 8 billion in the year 2025. Much of the world is now moving as fast as possible into a more affluent, energy-intensive era.

The combination of a rapidly growing world population with an increase in per capita use of energy carries with it great pressures on the environment and the atmosphere. Because the wind circles the earth within a few weeks, greenhouse gases emitted from each country quickly

Expert climate scientists from more than 50 countries agree that "the balance of evidence suggests that there is a discernible human influence on global climate." *Dr. F. Sherwood Rowland, Nobel Prize recipient, noted that global temperature records indicate an overall warming of about 1 °F over the last century.*

Due to human activities — primarily the burning of fossil fuels — atmospheric concentrations of several greenhouse gases have substantially increased *since the beginning of the Industrial Revolution. Dr. Mario Molina, Nobel Prize winner, noted that current projections indicate atmospheric concentrations will exceed 700 parts per million by 2100. This would be the highest level of carbon dioxide in the atmosphere in 50 million years.*

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become a global problem requiring a global solution. During the 1990s, the world called upon its scientists to evaluate the question of global warming from the accumulation of greenhouse gases. The authoritative IPCC has estimated a probable increase in global surface air temperature of about 3½ °F by the year 2100, with a possible range from 2 to 6½ °F. They further stated that the balance of the evidence suggests a discernible human influence on global climate, and warned that the average rate of warming will probably be greater than any experienced in the past 10,000 years. The variation in estimated outcomes depends upon what the countries of the world do to control the emissions of carbon dioxide and other greenhouse gases in the intervening years. More than 2600 scientists have now signed a statement on global climatic disruption in which, as scientists and as concerned citizens, we ask that the United States demonstrate strong leadership in the global effort with a firm proposal for reducing U.S. emissions of greenhouse gases.

THE VICE PRESIDENT: Now I'd like to ask Dr. Mario Molina to give us an overview of the science of climate change.

DR. MOLINA: I'd be pleased to do that, Mr. Vice President. The "greenhouse effect" is a process that affects the heat patterns of our planet. The earth receives energy from the sun, which passes relatively freely through the atmosphere. But the energy that the earth emits back to outer space is actually trapped by certain gases in the earth's atmosphere, which affects the earth's heat patterns. One of these gases is carbon dioxide, which is the most important greenhouse gas. And what we have in the figure is a representation of the amount of carbon dioxide in the atmosphere going back in time 160,000 years. The levels of carbon dioxide range between about 190 and 280 parts per million. We know this from measuring the composition of air bubbles trapped in ice cores from Antarctica and Greenland. The lower curve in the figure is a similar record of temperature going from the present back 160,000 years. There is a remarkably large correlation between these two curves. You can see that the preindustrial amounts of CO_2 are below 300 parts per million. The current concentration of CO_2 is roughly 365 parts per million. What is striking is that this is a level that we haven't seen before, certainly not in the past 160,000 years, and we got there very fast.

The next question is where are we heading? What happens in the future depends on what we do. If we continue with the so-called "business-as-usual" scenario,

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we can predict that we are going to reach levels of about 700 parts per million. And what is remarkable is how fast this would occur — in only the blink of an eye on the geological or evolutionary time scale. I should point out that the earth has actually seen such high levels of carbon dioxide in the past, but that was some 50 million years ago when the earth was a very different place from what it is now.

This is the sort of evidence that makes the scientific community consider this to be a serious problem. The magnitude and the pace of change are what make us really worry.

THE PRESIDENT: Thank you very much. Now, I'd like to call on Dr. Jane Lubchenco, our expert on ecology, and see what such significant changes in greenhouse gas levels might mean for natural resources.

DR. LUBCHENCO: Mr. President, Mr. Vice President, as both of you are aware, the ecological systems of the world — the forests, wetlands, coral reefs — provide the life support systems for all of life on earth. Important ecosystem functions, including flood control, purification of air and water, and the creation of beautiful places for recreation and inspiration can only be provided by intact ecological systems, and when those systems are disrupted or lost, then we lose the goods and services they provide. To provide a few vignettes of the ecological consequences of climate change, in the optimistic scenario of a doubled CO_2 world, let me invite you on a brief field trip to different parts of our country:

- Let's begin in the forests of New England, which like probably a third of the forests around the globe, will undergo major changes. For example, we would probably lose sugar maples from the New England forests.
- Let's move to the southern part of our country. Salt marshes in Louisiana are already being submerged. Climatic change would exacerbate this problem as sea

***Natural ecosystems will shift as individual species respond to changes in climate.** Rates of temperature change over the next century are expected to be faster than have been observed over the last 10,000 years. Dr. Jane Lubchenco predicted this will lead to loss of biological diversity and the services ecosystems provide for society, estimated to be worth trillions of dollars annually.*

DR. SCHNEIDER: Thank you very much, Mr. Vice President, Mr. President. What we're addressing at the moment is, "so what if the climate changes?" This is a question that scientists have spent a long time on, doing literally hundreds of studies, suggesting outcomes ranging from catastrophic to mild. Let's take a look at just two examples — the sea level question and the question of hydrologic extremes, droughts and floods. We all remember the terrible pictures from hurricane Andrew, which resulted in losses on the order of $40 billion in Florida and other areas around the Caribbean. Could we have had something to do with that? If you increase the temperature of the oceans, it increases evaporation, it might make storms stronger. That's very controversial. But one thing we know that isn't controversial is that before 1987 there were no losses larger than $1 billion. And now the insurance industries are very concerned that there have been several in the tens of billions.

What else do we know that's not controversial? Sea levels have gone up and are projected, typically, to go up six inches to maybe three feet, depending upon how things turn out in the next century. And whether storms are augmented in strength by global warming or remain at their natural levels, they'll be causing flooding from a higher sea-level base. As a result of that, the damages would go further inland.

What about the hydrologic extremes? Well, we all saw pictures of the 1988 drought. We know about the seemingly endless stories of floods now. And the question is, "Has nature rolled us a double snake eyes, or have we started to load the dice?" Again, physics says if you increase the heating of something that has water in it, more water will evaporate. So, what that suggests is that more water in the air means that when it does rain, the rainfall can be more intense. When it's dry, you can have more evaporation.

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The question is, what's happening? A line that we often use in science is, well, in God we trust, but for the rest of us, please show data. Dr. Tom Karl and his colleagues in North Carolina, for example, have concluded that there has been about a 10 percent increase in precipitation across the United States since 1910. The interesting part,

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as Tom says, is, "The increase in precipitation is reflected primarily in the heavy and extreme daily events." Translated: Gully washers. The bulk of the rainfall increase has been in those kinds of damaging, extreme events. A pattern is emerging, and the pattern is consistent with the expectations from our models. So, while no one event certainly could be laid to the doorstep of global warming, the increasing frequency and magnitude of severe storms could very well be the first signs of the canary in the cage starting to quiver.

The IPCC concluded with a paragraph I know well as a lead IPCC author, and I'll quote what it said in its last paragraph of the summary for policy makers. "When rapidly forced, nonlinear systems are especially subject to unexpected behavior." In my words, that means reducing the pressures humans put on nature is insurance against potential nasty surprises.

THE PRESIDENT: Thank you very much. Now, I'd like to ask Dr. Robert Shope, who studies infectious diseases extensively, to discuss how human health might be affected by climate change.

DR. SHOPE: Thank you, Mr. President. Health and the environment are closely linked. If there is a 6 °F warming, the heat alone in North American cities, such as Washington, D.C., will result in an excess of deaths, especially in elderly people who do not adapt well to severe warmth. We had an

***Mankind has dramatically altered the composition of the atmosphere** in the last 150 years. The concentration of carbon dioxide is 30 percent higher than it was in 1860 and is now higher than it has been in 160,000 years.*

example in July of 1995 in Chicago, Illinois. There the temperature exceeded 90 °F night and day for a prolonged period, and there were 465 deaths recorded in Chicago related to the heat.

My own personal experience is with diseases transmitted by ticks, mosquitoes, and other biting insects. Let me talk about dengue virus. This causes a disease in people which typically gives them high fever, headache, muscle aches and pains, and sometimes a rash. There is a more severe form of dengue, dengue-hemorrhagic fever, in which the case mortality rate is about 10 percent. This virus is transmitted by a mosquito that lives in and around homes in warm climates. The mosquito is killed by a hard freeze; therefore, it's northern limit is about Memphis, Tennessee, at the present time. In the last decade, we've seen a steady increase in the numbers of cases of dengue in tropical America, including Mexico. This disease is now literally on our southern border. I cannot tell you whether dengue epidemics will occur in the United States, but with climate change and warming, the mosquito will thrive further north.

These same factors apply to the vector of malaria, also a mosquito. Malaria is a disease that, worldwide, kills approximately 2 million people each year. It's a tropical disease, but recently has occurred in small outbreaks in the United States, in New Jersey, New York, and Texas, and with warming we can expect these outbreaks to continue and to enlarge.

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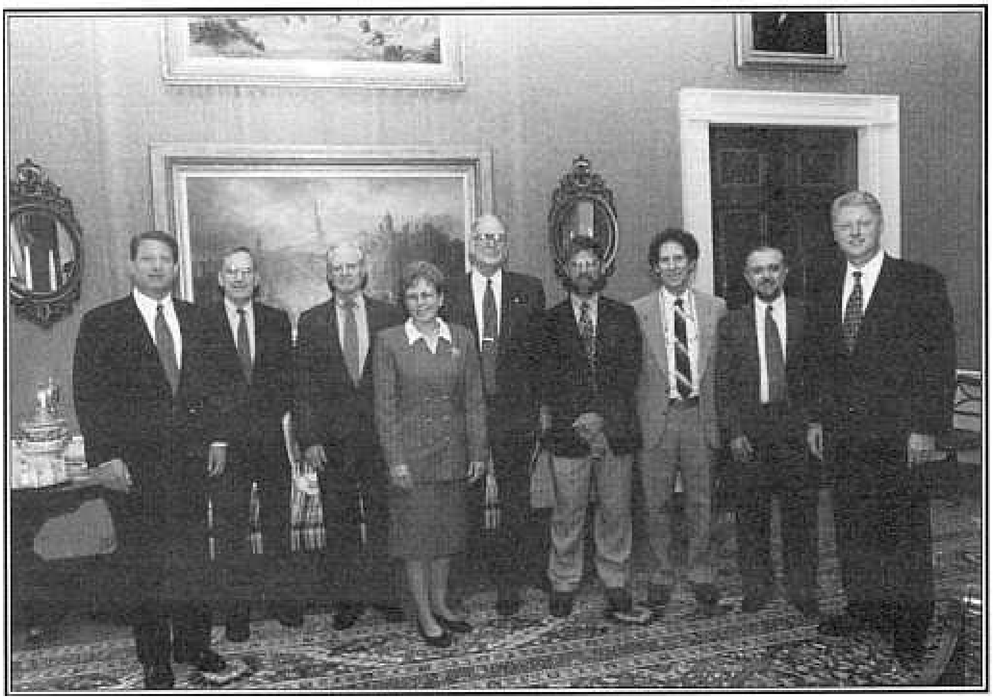
The factors that I've talked about argue for controlling the environment while we still have time, and I will say that the best insurance is preparedness. There are many other diseases directly affected by rainfall and warming — St. Louis encephalitis, the tick-borne Lyme disease, and the newly recognized rodent-associated Hantavirus pulmonary syndrome, which broke out in 1993 in the southwestern part of the United States. Each nation in the world has its own set of diseases, some of which affect Americans abroad or can be transported and introduced into the United States. Therefore, the problem of climate change and health is of common interest among nations as are the solutions. Thank you.



The vast majority of the world's leading climate experts are concerned *that human-induced climate change could have profound consequences for the economy, human health, and quality of life in future generations. Flanked by the Vice President and the President, the eminent U.S. scientists who contributed to the White House roundtable discussion of climate change are (left to right) Robert Shope, Henry Kendall, Jane Lubchenco, F. Sherwood Rowland, John Holdren, Stephen Schneider, and Mario Molina.*

THE VICE PRESIDENT: All right. I'd like to ask Dr. Henry Kendall, Nobel laureate and chairman of the Union of Concerned Scientists to speak to the international dimensions of the issue.

DR. KENDALL: Mr. President, Mr. Vice President, thank you for this opportunity. Disruption of the climate is linked to, and can aggravate, many other human problems. One link I'd like to talk about is the connection with world food production. Agriculture, as is widely recognized, needs a stable climate in order to be highly productive. But in 1988, in the central North American continent, with combined high temperatures and drought, both Canada and the United States lost one-third of their grain supplies. For the first time in 200 years, food production was not adequate to feed us. In the years since, Australia and Mexico have had somewhat similar events.

Food demand is expected to double in the next 30 years, which is almost no time at all. Fresh water, which is vital for irrigation, is already short. The human race uses nearly one half of the available fresh water, and 40 percent of the world's population lives in areas that are water short.

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Expansion into new arable land is highly constrained, and the last thing we need are climatic changes and disruptions putting additional pressures on a system that is already becoming considerably stressed. Of course, it's the bottom tier of the developing nations that will get hit directly by shortages. This has already started to generate increasing numbers of hungry migrants, environmental refugees, streaming across national borders. The result is that no nation will be sheltered from the effects of dislocations in food supplies, altered trade balances, and fresh water difficulties. The flow of migrants may increase into the hundreds of millions of people. And even though the wealthy nations will remain able to feed themselves, and remain well fed into the future, no nation will escape troubles from pressures on the food supply. Mr. President, it is not the case that one end of the boat can sink, so let me say that this is a developing problem in national security, and we have to deal with it. The best way to deal with problems of this sort is to stop them at the outset and not wait until the results are presented to us and the great troubles have developed. Thank you.

THE PRESIDENT: Thank you. I'd like to now turn to Dr. John Holdren, who's worked on many global issues. Why do you think people are underrating the importance of the climate change issue, and what do you think we can do about it?

Climate change is a global issue requiring a global response. *President Clinton has stated that "we have to ask all nations, both industrial and developing, to participate in this process. We have to emphasize flexible, market-based approaches. We have to embrace research and development efforts in technology that will help us to improve the environment while permitting our economy to grow. If we do this together, we can diffuse this threat, and we can make the twenty-first century what it ought to be, not only for our children, but for all the children of the world."*

DR. HOLDREN: I think, Mr. President, Mr. Vice President, there are at least six reasons why most people underrate the seriousness of the climate disruption problem. I think the first reason that people tend to underrate this problem is that human well-being is a lot more dependent on climate than most people think. As you heard today, we're talking about the productivity of farms and forests and fisheries. We're talking about the frequency and intensity of floods and droughts and heat waves. We're talking about the geographic pattern of disease. We're talking about sea level rise and associated destruction of coastal property. And we're talking about the potential for political tension and conflict over the consequences and over who's responsible and who should pay.

The second reason people tend to underrate this problem is that climate disruption is a lot further along than most people think. As we've seen, atmospheric carbon dioxide is already higher than it's been in the last 160,000 years. The global surface temperature, which is expected to lag behind increasing carbon dioxide concentration, is higher than it's been in the last thousand years.

The third reason that many people are more complacent than they should be is that the climate implications of future growth in population and future growth in energy consumption are a lot bigger than most people think. We're going to have in the year 2050, barring near disaster, something like 9 billion people compared to less than 6 billion today. We're going to have energy use under "business as usual" that will be three times higher than today's and CO_2 emissions that are 2 to 2½ times today's worldwide.

The fourth point is that scientific uncertainties are not grounds for complacency, in spite of what many people may think. There are uncertainties about many of the details of timing and magnitude and regional variation in the consequences of climate change, but there is no uncertainty at all that humans have significantly altered the global atmospheric concentrations of gases we know to be critical in controlling climate. And there's a solid consensus among the scientists who have studied these matters seriously that the chances of significant impacts on human well being from climate change over the next few decades are substantial.

The fifth reason that people underrate the problem is that the time lags between cause and effect and between effect and remedy are longer than most people think. Those time lags and above all the several decades that it will take to substantially successfully transform the world's fossil fuel-dependent energy supply system mean that doing nothing is a very dangerous course of action. The world's energy-economic system is a lot like a supertanker, very hard to steer and with very bad brakes, and we know from the science that has been reviewed here today that that supertanker is heading for a reef. Even though we can't say exactly when we're going to get to the point where that reef rips the bottom out of the supertanker, it's a bad idea in these circumstances to keep on a course of full speed ahead.

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The last reason that people tend to underrate this problem is because the fate of industrialized and less developed countries is a lot more interconnected than most people think. We all live on this planet under one atmosphere. We all live on the shores of one global ocean. Our countries are linked by flows of people, money, goods, ideas, images, drugs, and weapons. If we in the industrialized countries are to enjoy a stable and sustainable prosperity, we are only going to be able to manage that if we can achieve for the rest of the world now less fortunate a stable and sustainable prosperity as well. And the only way to do that is going to include addressing the danger of global climate disruption in a cooperative way.

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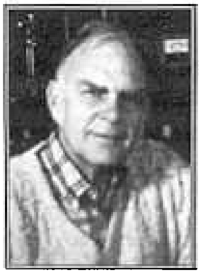
THE VICE PRESIDENT: Thank you.

THE PRESIDENT: I wish every American could hear what we've heard today. This is the beginning of a consistent, long-term effort that we all have to make to involve the people of this country in this decision. And I thank you all for the points you've made because in different ways each of them will resonate with citizens of this country in a way that I believe will give us the support we need to take the action that has to be taken. In the weeks and months ahead, the Vice President, the Cabinet, other members of the Administration, and I will be out in the country discussing this. We will be working with the American people. We will be talking about solutions as well as problems.

Biographies



Dr. F. Sherwood Rowland
(Nobel Laureate in Chemistry, 1995, Professor at University of California, Irvine, Foreign Secretary for the National Academy of Sciences, Past President of the American Association for the Advancement of Science)

In 1995, Sherwood Rowland, along with two of his colleagues, won the Nobel Prize in Chemistry for pioneering research in atmospheric chemistry of the destruction of the ozone layer. Since receiving his Ph.D. from the University of Chicago in 1952, he has climbed the academic ranks in chemistry, and is currently the Donald Bren Research Professor of Chemistry and Earth System Science at the University of California at Irvine. Dr. Rowland has received many awards including the Roger Revelle Medal from the American Geophysical Union. He also currently serves as the Foreign Secretary of the National Academy of Sciences, and is a former President and Chairman of the Board of the American Association for the Advancement of Science.

Dr. Mario Molina
(Nobel Laureate in Chemistry, 1995, Professor at Massachusetts Institute of Technology, Member of the President's Committee of Advisors on Science and Technology)

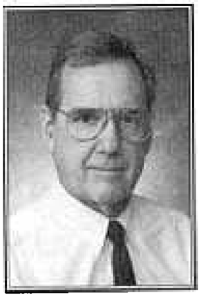
Mario Molina was awarded the Nobel Prize along with Sherwood Rowland for research on the thinning of the ozone layer. Dr. Molina and his colleagues demonstrated experimentally how ozone-destroying chlorine functions in the atmosphere. He is currently the Lee and Geraldine Martin Professor of Environmental Science at Massachusetts Institute of Technology. Since completing his Ph.D. in physical chemistry at the University of California, Berkeley, Dr. Molina has received many honors and awards, including election to the National Academy of Sciences, and selection as a Pew Scholar on Conservation and the Environment. He has also served as an advisor to the National Aeronautics and Space Administration, the National Science Foundation, and the National Institutes of Health.

Dr. Jane Lubchenco
(Professor at Oregon State University, Past President of both the American Association for the Advancement of Science and the Ecological Society of America)

Jane Lubchenco is currently the Wayne and Gladys Valley Professor of Marine Biology and Distinguished Professor of Zoology at Oregon State University, and has been awarded a litany of honors. She has been selected as a Pew Scholar in Conservation and the Environment, a MacArthur Fellow, a member of the National Academy of Sciences, and a member of the National Science Board. She is also an American Academy of Arts and Sciences Fellow, an American Association for the Advancement of Science Fellow, and has received numerous teaching awards. She has accomplished all of this since receiving her Ph.D. from Harvard University in 1975.

Dr. Stephen Schneider
(Professor at Stanford University, MacArthur Fellowship, the American Association for the Advancement of Science Westinghouse Award for Public Understanding of Science and Technology)

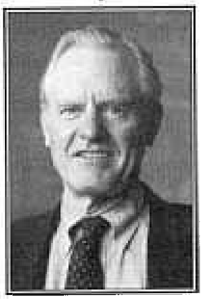
After receiving his Ph.D. in Mechanical Engineering and Plasma Physics from Columbia University in 1971, Stephen Schneider focused on the influence of greenhouse gases and suspended particles on the earth's climate as a postdoctoral researcher at NASA's Goddard Institute for Space Studies, and later at the National Center for Atmospheric Research, where he remained until 1996. In 1992, Dr. Schneider was awarded a MacArthur Fellowship for his ability to integrate and interpret the results of global climate research through public lectures, seminars, media appearances, and research. He was also honored with the American Association for the Advancement of Science Westinghouse Award for Public Understanding of Science and Technology for his ability to express environmental science and its implication for public policy to the general public. Currently he is a Professor in the Department of Biological Sciences and a Senior Fellow at the Institute for International Studies at Stanford University.



Dr. Robert Shope
(Professor at University of Texas, Director of the Yale Arbovirus Research Unit for 24 years)

Robert Shope has devoted his career to the study of viruses carried by mosquitoes, ticks, and other biting insects. These viruses can cause life-threatening diseases in humans such as malaria, dengue and yellow fevers, and encephalitis. Since receiving his medical degree in 1954 from Cornell University, he has spent many years in Malaysia, Brazil, and other tropical sites studying these insect-borne diseases. He was a Professor of Epidemiology at Yale University's School of Medicine from 1975 to 1995, and served as the Director of the Yale Arbovirus Research Unit. During that period he was awarded many honors, including the Walter Reed Award from the American Society of Tropical Medicine and Hygiene. He is presently a Professor in the Departments of Pathology and Microbiology and Immunology at the University of Texas Medical Branch.

Dr. Henry Kendall



(Nobel Laureate in Physics, 1990, Professor at Massachusetts Institute of Technology, Chairman of the Board of the Union of Concerned Scientists)

In 1990, Henry Kendall won the Nobel Prize in Physics, along with two colleagues, for his insightful work in particle physics. Dr. Kendall is currently the J.A. Stratton Professor of Physics at the Massachusetts Institute of Technology. He also serves as the Chairman of the Board of the Union of Concerned Scientists, an organization which he helped found in 1994. Throughout his career, Dr. Kendall has focused on U.S. energy and defense issues such as the nuclear arms race, nuclear power, and renewable energy. He has many other awards and honors including being elected to the National Academy of Sciences.

Dr. John Holdren
(Professor at Harvard University, member of the President's Committee of Advisors on Science and Technology

John Holdren is a world-renowned expert on energy and environmental science. In 1995, he delivered the Nobel Peace Prize acceptance lecture on behalf of the Pugwash Conferences, on the occasion of that organization's sharing of the 1995 prize. He is currently the Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy in the John F. Kennedy School of Government, and Professor of Environmental Science and Public Policy in the Department of Earth and Planetary Sciences at Harvard University. From 1973 to 1996, he was a Professor of Energy and Resources at the University of California at Berkeley. He has been elected ..a Fellow of the National Academy of Sciences, the American Physical Society, the American Association for the Advancement of Sciences, the California Academy of Sciences, and the American Academy of Arts and Sciences. He was also awarded the MacArthur Foundation Prize. Dr. Holdren received his Ph.D. from Stanford University in aeronautics, astronautics and theoretical plasma physics in 1970.