

**2006 National Environmental Public Health Conference**  
**Advancing Environmental Public Health: Science, Practice, New Frontiers**  
**Wednesday, December 6, 2006**  
**11:15 AM Plenary Session 6**

**Henry Falk, MD, MPH, Director,**  
**Coordinating Center for Environmental Health and Injury Prevention,**  
**Centers for Disease Control and Prevention**

Good morning. My name is Henry Falk and I'm the Director of the Coordinating Center for Environmental Health and Injury Prevention at CDC. The title of this plenary session is "Working Together to Improve Environmental Public Health." We couldn't have a more wonderful group here to discuss that theme and to follow up on the Surgeon General's remarks.

So let me begin by introducing our first speaker. It's Administrator Stephen Johnson of the EPA and Administrator Johnson was sworn as the 11th Administrator of the U.S. EPA on May 2, 2005. He heads an agency of over 18,000 employees nationwide, with an annual budget of \$8.6 billion. So Mr. Johnson has been a part of the EPA for 25 years. As someone who's been a part of CDC for 35 years, it's just great to see somebody with a real commitment to public service and a distinguished career in the federal government as administrator. Prior to that Administrator Johnson was Assistant Administrator of EPA's Office of Prevention, Pesticides and Toxic Substances from June 2001 to July 2003.

That office has responsibility for implementing the nation's pesticide toxic substances and pollution prevention laws. He had served for many years in the Office of Pesticide Programs at EPA, where he administered the Pesticide Registration Program, which has had a great many important impacts on our country. He has represented EPA at many international pesticide forums, including those sponsored by the United Nation's World Health Organization and the Organization for Economic Cooperation and Development. And he's also worked in other parts of the EPA, such as the Office of Research and Development and the Office of Toxic Substances. Administrator Johnson has received numerous awards and commendations. In 2001 he received the Presidential Rank Award for distinguished executives for sustained extraordinary accomplishments, the highest award given to a civilian federal employee. He has also received the EPA's Excellence in Management Award and the Vice President's Hammer Award for streamlining the Pesticide Registration Program. Mr. Johnson received a BA in biology from Taylor University in Indiana, an MS in pathology from George Washington University, and an honorary doctorate of science from Taylor University.

I just want to point out that the EPA's Web site describes the Administrator's Action Plan. It talks about three principles for accelerating the pace of environmental protection. One results in accountability, the importance of EPA being critical steward both of the environment and of the funds it receives. Second is innovation and collaboration, which is very much speaking toward today's theme. Meeting the environmental challenges requires new and collaborative approaches. And the third is utilizing the best available science, and EPA will continue to use the best available science for its decision making. So it's a real privilege for me to introduce Administrator Johnson and to tell him how delighted we are to have him here this morning. Thank you.

**Stephen L. Johnson, MS, Administrator,**  
**United States Environmental Protection Agency**

It really is a pleasure to be here and thanks for that introduction. I also want to thank Julie Gerberding and Henry for inviting me to speak here at the conference today. Julie and Henry are long-time colleagues of mine, and in addition to being colleagues, they're also great friends. I believe it's through that collegial relationship and friendship that the EPA and CDC relationship has been brought new heights, and we've got more work to do.

I have to admit that this audience is not the typical audience that I speak to. Most of my speeches are in front of environmental professionals, industries regulated by EPA, and trade associations with a direct interest in environmental issues. Recently I spoke at the FFA Convention attended by 55,000 screaming FFAers and I must admit it was some introduction there when I walked on stage with laser lights and smoke. But it's hard to imagine any other group whose work is more vital to EPA and whose cooperation is more critical to our success than you, America's health professionals.

The theme of the conference, "Advancing Environmental Public Health," is something very near and dear to my heart because it's a goal which my agency shares with yours.

At EPA our mission is very straightforward — to protect public health and the environment. And of course CDC's mission is to promote health and quality of life by preventing and controlling disease, injury, and disability. Even though health professionals and environmental professionals perhaps go about our work in somewhat different ways, we both are in the same business —improving people's lives in part by protecting them from the threats of environmental contamination.

As Dr. Frumkin noted in his opening remarks, our nation's accomplishments in the field of environmental public health really are remarkable. Together we are preventing communicable diseases, providing safe

drinking water, and treating wastewater. We're promoting a safe and healthy food supply and responsibly managing our wastes.

America's come a long way in understanding that an increase in economic growth does not necessarily mean a decline in environmental health. Let me give you some statistics. Since 1970, our gross domestic product has nearly tripled. Over that time our energy use rose by nearly one-half. Our population has grown by 40%. Vehicle traffic has almost tripled. And yet even with all this additional strain on our natural resources, the emissions of six critical air pollutants has actually decreased by more than 52%.

We're building on these successes at home and throughout the world. Next week I'll be joining Secretary Leavitt and four other members of the president's Cabinet on a trip to China, a trip to promote strategic dialogue with the Chinese government leaders on economic issues. I'm very pleased that EPA has been invited to participate in the dialogue that will be occurring at the end of the week in Beijing. All of us in health and environmental fields should be encouraged that the president has recognized the key link between economic growth and environmental protection at home as well as abroad. In the United States we've seen that good environmental policy yields good economic results. And by sharing the lessons learned from our experiences, my hope is that China and America will move together toward a cleaner, healthier, more productive future for both our nations.

It's important to note that none of America's environmental progress would have been possible without the scientific leadership, collaboration, and support of environmental and public health colleagues. On behalf of my EPA colleagues I want to thank all our federal partners at CDC, ATSDR, the Institutes of Health, and of course many others. I also want to thank all of you who are the frontline practitioners in state and local health agencies, who are in the labs, who are in the academic world, and who are in the private sector for your outstanding work. It's EPA's ongoing partnerships with your organizations that are necessary and vital to the health of our nation and our residents.

As I set down some operating principals for my agency, I identified five priority areas. One priority is healthy communities, because my 26 years of experience at EPA has shown me that healthy ecosystems equal healthy communities. And we need to be focusing on our healthy communities.

I'd like to say that it really doesn't take a doctoral degree to understand that the health of our environment has a lot to do with the quality of our lives. That's why I put healthy communities and ecosystems on my very short to-do list. As with all of our goals, EPA is working to better collaborate with our partners to hand down a healthier, cleaner America to all our residents. I believe it is collaboration and cooperation not only within the federal family but throughout ... that has the possibility of limitless positive health impacts for today and the future. Because of your role and capability in providing critical health information, I

believe we're making a real difference in people's lives.

One of the ways we're working together is to restore contaminated properties to environmental and economic vitality, which is one of my policy goals under healthy communities and ecosystems. For example, one distinct sort of expertise is delivering results through our Superfund program. While EPA focuses our attention on remediation, the medical professionals at ATSDR bring unmatched human health credibility and information to each project to help the cleanup professionals.

Another area of cooperation is the cleanup of contaminated brownfield sites where we take problem properties and turn them back into economic, environmental, and public health assets. This program employs a collaborative model of environmental protection. It forges strong public-private partnerships and promotes innovative and creative solutions to some of the nation's most pressing challenges. We can have conferences, we can talk about things, but are we delivering results? This program is working by encouraging the cleanup and redevelopment of America's abandoned and contaminated waste sites. EPA's brownfield program has leveraged more than \$8.5 billion in private investment, helped create 39,000 jobs, and resulted in the assessment of more than 8,600 properties. These are impressive numbers.

But the brownfield program isn't just about improving local environments and economies through our commitment to urban development and redevelopment. EPA and all of our partners involved with remediation are providing communities a healthier, more productive future.

Another way EPA is bridging the gap between environmental programs and the public health is through a program we launched a few years ago, Community Action for Renewed Environment. For those acronym aficionados, it's CARE. Through this community-based program, EPA works with CDC and other organizations to help us become better partners with the local communities. I think most of you are familiar with a famous quote by the late Speaker of the House, Tip O'Neill, "all politics are local politics." Well the same is true for the environment: All environmental actions are local. Through the CARE program, President Bush and EPA and CDC are putting communities in the driver's seat so they can deliver real environmental results to their residents. With CARE, EPA is a partner, a facilitator, and a resource to help communities become better stewards of their local environments.

All of our organizations have complementary resources and skills, and by working together and combining our unique skills we can make a real difference in helping to meet our nation's healthy community goals.

EPA and CDC are also working together to promote healthy communities and ecosystems by continuing to reduce the incidence of childhood lead poisoning, another of my policy priorities. With the help of our colleagues here and at HUD and other partners we're focusing on reaching our 2010 goal of eliminating

childhood lead poisoning. While EPA is renovating homes with lead-based paint, making sure lead-safe work practices are understood, and enforcing the laws that are on the books, we are also relying on CDC's excellent work on tracking the progress. And we're seeing a difference, which is very exciting. It's really evident that we're both in the same business and through collaborating and combining our resources and skills we are providing and we will provide Americans a healthier, safer environment.

All environmental health professionals focus not only on what we can do today but what we can do for a better tomorrow. This need for a forward-thinking approach was never more necessary than in the aftermath of Hurricanes Katrina and Rita. The government-wide response effort gave new meaning to the term collaboration. CDC played a major role in assessing the environmental and long-term health impact of water and sediment in New Orleans and other areas. I want to thank you very much for your hard work. Julie Gerberding became a calm voice of reason in the midst of anxiety and confusion. I appreciate her joining me at a number of press conferences to help us as a government to provide important health information to residents of the region and to the American people.

The lessons of preparedness and cooperation that we took away from the response to the hurricanes have led to a new level of collaboration in readying for the arrival of the avian flu. While EPA only plays a supporting role in this effort, we certainly stand ready to join HHS, CDC, and the rest of our federal partners in protecting the American people from a possible pandemic.

As we look to the future, I believe our ability to share and process information will become even more essential in protecting the United States from environmental and biological threats. Tools like our Integrated Risk Information System and the National Health and Nutrition Examination Survey are helping us to create models, identify patterns, and predict future spread of diseases and environmental exposure. And as our nation continues to focus on homeland security, the collaboration between CDC, EPA, and our other federal partners will become even more crucial. However, systems are only as good as the people who operate them. As a 26 year veteran EPA employee, I'm committed to ensuring that my agency is prepared for the future by hiring and training a diverse, talented, and highly skilled workforce — one of my other priorities. As we work toward a stronger EPA, the ultimate goal is to prepare for a stronger federal government, equipping those who will understand the value of collaborating and delivering results to the American people.

In order to continue down that road of cooperation between EPA and CDC, we're exploring innovative ways to learn more about each other, strengthen the lines of communication, promote understanding, and focus on emerging concerns. And I'm pleased to announce today that I've asked one of our most senior experienced staff members, Stan Meiburg, currently our Deputy Regional Administrator here in Atlanta, to move to ASTDR and work directly with Dr. Frumkin and his colleagues to help us jointly pursue the goals

of systems integration and working together. He will be returning to his Deputy Regional Administrator position at the end of two years. I think this is just a great opportunity and frankly I think that this is a model for the future of federal government. Thank you.

As we continue to work together in the business of improving people's lives and protecting them from the threats of environmental contamination, I really do look forward to more successes with our partners here at CDC. Thanks so much. And keep up the great work.

**Henry Falk, MD, MPH, Director,**

**Coordinating Center for Environmental Health and Injury Prevention**

**Centers for Disease Control and Prevention**

Next I would like to introduce Dr. David Schwartz, who's the fourth director of the National Institute for Environmental Health Sciences. We very much appreciate him being here today.

Dr. Schwartz oversees the institute's comprehensive research programs and basic and applied research to reduce the burden of human carcinomas triggered by the environment. He also is the director of the National Toxicology Program, which has been based at NIEHS since 1978. Prior to NIEHS, Dr. Schwartz served at Duke University where he was Vice-Chair for Research and Director of the Pulmonary and Critical Care Medicine Program and very heavily involved in multiple ways at the university dealing with the issues of environments and genetics and played a pivotal role in establishing a number of interdisciplinary centers at Duke, including environmental health sciences, environmental genomics, and environmental asthma. He's made many contributions over the years in the area of pulmonary medicine and chronic pulmonary diseases. He has a very strong interest in the pathology and biology of asbestos-related lung disease; other interstitial lung diseases; lung scarring and pulmonary fibrosis; environmental airway disease; and the innate ability of the lungs to function and how they respond to the environment. He's authored more than 150 scientific papers and 38 book chapters, a very prolific educator. He is recipient of the American Thoracic Society Award for his accomplishments there in 2003. Dr. Schwartz has a BA in biology from the University of Rochester; a medical degree from the University of California, San Diego; completed an internship residency and chief residency in internal medicine at Boston City Hospital, fellowship and occupational medicine, earned an MPH and a prestigious Robert Wood Johnson Clinical Scholar Program.

I actually got to know David best when he was at the University of Ohio and the faculty there and working on occupational and pulmonary medicine. We did a cooperative agreement with his program looking at Gulf War Syndrome, which as many of you know is about as challenging an issue as one can face. They did a great job there and a really outstanding investigation. So I very much value the work over the years

that we at CDC and ATSDR have done with NIEHS. I value our relationship with David and particularly in the work that he has done. And we continue to work in places from Libby, Montana, to the East Coast. I welcome Dr. David Schwartz, Director of NIEHS. Thank you.

**David A. Schwartz, MD, Director,**

**National Institute of Environmental Health Sciences**

Henry, thanks very much for that very generous introduction. It's really a pleasure to be here and to talk with the health professionals.

I do want to mention that I think ATSDR, EPA, CDC, and NIEHS are really joined at the hip in terms of the Superfund program. The Superfund program functions in a way that emulates a lot of the collaborations that are developed in much smaller programs and are relevant to the partnerships we can create in the future. Partnerships are really not built through administrative approaches but through personal relationships. As Henry mentioned, we worked together about 12 years ago on the Persian Gulf problem. The fundamental partnership we created is something that I hope to build on between NIEHS, CDC, and ATSDR.

The National Institute of Environmental Health Sciences is one of 18 institutes at the NIH. It's unique in that it focuses on environmental sciences. It's also unique in being the only NIH institute that's outside of Bethesda, in the Research Triangle in North Carolina.

I'd like to spend just a little bit of time telling you what we do, how we contribute to environmental sciences, how we contribute to the partnerships in environmental sciences especially with the CDC and ATSDR, and what we aspire to do in the future.

When we think about the scientific accomplishments at NIEHS, there are two basic categories. First, we've done really outstanding research in very basic areas of biology defining receptors, defining signaling molecules, and understanding oxidative stress and DNA damage. We've also participated in outstanding public health research in basic epidemiology. Probably one of the best examples and very relevant to this audience is the work the Harvard group did under Doug Dockery's direction to identify the importance of air pollution in terms of pulmonary and cardiovascular morbidity and mortality. This led to changes in the standards for air quality in the United States and also to a rethinking of air quality around the world. In fact these changes in follow-up studies clearly affected morbidity and mortality in the United States.

When we thought about this, and we thought about this critically, it also raised a number of very important scientific opportunities — opportunities as they relate to etiology and susceptibility and also to

understanding disease pathogenesis, how air pollution affects biological processes that in turn have an effect on pulmonary and cardiovascular morbidity and mortality.

As we began to think about the spectrum of research opportunities from very basic to very applied research, we realized there were opportunities in integrative research — applying very basic biological principals to understanding the distribution of disease in populations by focusing on diseases that are complex in nature. This not an exhaustive list of the diseases that we're interested in but it illustrates the complexity of these diseases in terms of the multiple exposures and the multiple genetic factors that are inherent in the risk of developing these diseases.

Now we view this as a scientific opportunity that's unique to this point in time because of the technological advances that have occurred over the past two decades. Let me give you one example of that. Recently a very important publication came out that mapped genetic variation across populations and individuals within populations. Basically, this publication and this knowledge have led to a marked decrease in the cost of doing genetic studies. Prior to this publication, it cost approximately \$10 billion to study a particular disease and understand the genetics of that disease. After understanding the sequence variation across individuals, it now cost somewhere around \$2 million per disease to study. Over a 10-year period, by focusing on genetic variation, investigators were able to reduce the cost of doing a genetic study 5,000-fold and made genetic study very feasible in these complex diseases. So our intent at NIEHS is to use environmental sciences as a way to understand human biology and disease processes, especially these complex diseases that are now understandable by looking at genetic and environmental factors. The idea is to use the environment as a way of taking these very complex diseases and narrowing the pathophysiological phenotype so that we can understand the biology and the genetics that underlie these disease processes.

Let me give you two examples, one in terms of fetal origins of disease and another in terms of genetic susceptibility. In terms of fetal origin of disease, a very interesting evolving area of science called epigenetics is very relevant to environmental health sciences. In the most general terms, it can be explained as environmental stress alters gene expression and that altered gene expression affects the risk of developing disease. Several basic mechanisms underlie this simplistic description. The basic mechanisms involve methylation of DNA, and methylating DNA specifically at promoters of genes suppresses the expression of those genes. Methylation is very sensitive to dietary and environmental stimulation.

Methylation sites on genes can be inherited from either your mother or your father; the tendency to express a maternal or paternal gene is exquisitely dependent on the state of methylation.

A third mechanism related to epigenetics has to do with the proteins, the histones that DNA wraps around.

Histones can be modified either by dietary or environmental exposures and that modification results in differential gene expression. Let me give you a dramatic example of that. The agouti mouse is a C57 (black 6) mouse, a strain of mouse that has inserted into it an agouti gene that either makes the mouse tan when it gets expressed or brown if it doesn't get expressed. It acts as a way of looking at gene expression. When the gene is not metholated, it gets expressed and you have a tan mouse. When the gene is metholated, it doesn't get expressed and you have a brown mouse. These mice are genetically identical, but have very different colors and very different characteristics.

Randy Jirtle at Duke University hypothesized that if you feed pregnant mice metholating agents, B12 and folate, which are common in the diets of pregnant women, you could alter the code color of these mice depending on the state of metholation. Basically he showed that if you gave a pregnant mouse a high folate, high B12 diet, you suppressed the expression of the agouti gene and the mouse was brown. If you gave a pregnant mouse a low folate, low B12 diet, the agouti gene was expressed and the mouse was tan. Now these two mice are genetically identical. It's just that their moms were subjected to different diets, a high foliate and high B12 diet in the case of the brown mouse, a low folate and low B12 diet in the case of the tan mouse. You can see that phenotypically they are quite different. In fact, the agouti mouse not only expresses the agouti gene but it clearly develops obesity. It's at risk of developing diabetes and also at risk for developing various forms of cancer.

Now what does this have to do with environmental exposures? In fact a very important paper came out in *Science* recently showing that endocrine disruptors affect gene expression and affect male fertility through this same mechanism of metholation. These endocrine disruptors are very common in the environment. Vinclozolin, a fungicide used in the wine industry, was one of the experimental agents used in this study. How does this affect life-long risk of developing disease? Another very interesting study was recently published that showed that individuals change their state of metholation throughout life so that monozygotic twins early in life have very similar states of metholation whereas older monozygotic twins have very different states of metholation, clearly dependent on life experiences, diet, and environmental exposures. Probably a variety of other factors contribute. This represents a very important area of research, one that we're investing heavily in and I think will have profound effects in understanding how environmental exposures combine with dietary factors to affect the risk of developing diseases in populations.

The second area that I want to mention is gene susceptibility, especially as it relates to complex disease. This figure illustrates all the loci across the genome in humans that have been identified as being associated with the risk of developing asthma. In this slide you can see that for each chromosome there are some purple bars to the side of those chromosomes; those are the loci that have been associated with the risk of developing asthma. Almost every single chromosome is associated with the risk of developing asthma. This

is no small surprise because asthma is a very complex disease that's caused by multiple exposures. It has many different phenotypes. It has very different biology, and probably what one investigator is looking at as asthma is very different than other types of asthma.

Now how can we use environment as a way of simplifying this? One idea is that different types of asthma rely on different types of biology, so that the biological phenotype and the genetics that underlie how house dust-mite induced asthma is probably very different than ozone-induced asthma, which is very different than endotoxin-induced asthma. In fact, focusing on those different types of asthma environmentally is a way of identifying the genes and the biology that underlie those different types of asthma. As an example of that, in my own research we've identified a polymorphism in the receptor of endotoxin that makes individuals resistant to developing endotoxin-induced asthma. Interestingly, we were able to use the same polymorphism that reduces the risk of developing endotoxin-induced asthma to find out that endotoxin and other toxins released by microbial organisms are important in common complex disease like atherosclerosis. Individuals with this polymorphism were not only at decreased risk of developing endotoxin-induced asthma, they were also at decreased risk of developing atherosclerosis because they had a lower inflammatory state in the peripheral blood. This is a way that environment can be used to identify basic biological principals that may be very important in terms of the risk of developing a variety of complex diseases.

So as I mentioned, we're focusing on integrative and clinical research as one of the areas we want to develop at NIEHS in addition to continuing to support basic research and continuing to support research that focuses on public health.

We're doing this by developing an office of translational research. We've recently recruited Bill Martin from the University of Cincinnati who was previously dean of the School of Medicine at the University of Cincinnati to head up this office. We're also developing some very specific programs—the Discover Program in the extramural community, the Director's Challenge in the intramural program—to get basic and applied investigators to work together to focus on a disease that's relevant to environmental health sciences. We're also building a clinical research unit at NIEHS so we can provide our basic investigators an opportunity to work with human samples and to focus on human diseases.

In addition, we're training and recruiting scientists that are interested in interdisciplinary research. In fact, we're expanding the pipeline to focus on high school students and college students, and we're developing programs specifically directed at them. We're developing programs that focus on times of transition — individuals moving from mentored to independent research. We've recently developed a program called the Ones Program that focuses on new R01 or independent research recipients to help build careers in environmental sciences. We're developing interdisciplinary programs in our training portfolio so we can

get individuals interested in environmental sciences to do work in public health, clinical research, genetics, chemistry, engineering, or physics as a way of expanding environmental sciences and incorporating other research approaches.

We also focus on global environmental health. Our first program focuses on New Orleans and the individuals moving back to New Orleans who are exposed to very high concentrations of microbial contamination in their schools and homes. We've initiated a project that looks at children in schools and tries to approach the environment as a way of reducing the risk of asthma exacerbations, reducing the risk of developing asthma among those children, and studying the genetic factors that alter the risk of developing asthma within that population.

This work is dependent on public and private partnerships, and the Merck Children's Asthma Network is a partner in the New Orleans program that focuses on asthma in children. It's also part of the much bigger program to develop research capacity globally to expand environmental sciences. We've developed a program that makes it very easy for folks outside the United States to get training with investigators at NIEHS and focus on environmental health sciences.

Importantly, however, we're developing a very clear research agenda in global environmental health. We are planning a workshop in January that Henry and a number of individuals from around the world are going to participate in; the goal will be to develop a compelling issue in environmental sciences that NIEHS and its partners can focus on as a way of reducing the burden of disease globally. As an example, we know that air pollution is associated with high rates of respiratory and cardiovascular morbidity and mortality and we know that indoor air is a major problem globally. We also know that respiratory infection is a major problem affecting morbidity and mortality in children around the world. NIEHS currently is not invested in a program that focuses on reducing the burden of respiratory disease in children globally, nor are we focused on intervening in that process to affect the outcome for these children. This could potentially be a focus of our global environmental health program.

In addition, we're refocusing efforts in environmental genetics and genomics to take advantages of opportunities in epigenetics, the area of science that I presented initially. In comparative genomics, researchers are able to look across different model systems and move genes in and out readily to understand gene function and gene response to environmental stress and further develop cohort studies that look at gene-environment interaction.

One program I want to tell you about in more detail is our genes and environment initiative. To make headway in environmental sciences we simply need much more precise measures of exposure that will tell us what individuals have been exposed to and what individuals are responding to biologically. With the

help of the other institute directors at NIH, as well as working very closely with Director Francis Collins at NHGRI and NIH Director Elias Zerhouni, we developed a gene and environment initiative that's funded at \$192 million over the next four years to focus on two areas. One, a program in genetics association studies using the technology that I introduced previously will receive approximately \$100 million. Two, an environmental biology program that focuses on physical activity, dietary changes, chemicals and biologics in the environment, and psychosocial stress is funded at about \$88 million.

The program in environmental biology is something we will head up at NIEHS and work with the other institutes to implement. The program involves four components. One, we will develop environmental sensors that detect what individuals are exposed to at the point of contact. Two, we will develop a series of biomarkers that inform us about biological response to agents in the environment, different forms of environmental stress, to try and understand why some individuals respond to those forms of environmental stress and others appear to be somewhat resistant. Three, we will develop deployable devices for use in studies as a way of characterizing what individuals are exposed to and what they're biologically responding to during the course of observation. Four, we will combine this environmental information with the genetic factors to see how genes and environmental exposures interact in terms of the risk of developing the complex diseases that are found across the United States in populations that all of you care for.

So as we look forward, I want to present our five-year goals. One I mentioned already, which is in the area of environmental sciences. I believe with the genes and environment initiative we're going to make tremendous headway in terms of developing environmental measures of exposure and biological response indicators. I think that we'll be able to develop around a dozen or two dozen of these indicators over the next five years.

The second goal is to focus on complex human diseases. I think the environment can be used very effectively to understand the genetics, biology, pathophysiology, and expression of disease in populations particularly as they relate to many of the common diseases that plague Americans.

The third goal is in global environmental health. I think with the investments that we've made, with the program that we're developing, with the excitement that I see in terms of developing a future for global and environmental health, we're going to develop a program that's focused on particular diseases and individuals at risk of developing those diseases. Also, we look to build capacity globally to attack those problems and create other programs in environmental health sciences.

**End of Plenary Six**

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