NIEHS and Public Health Practice

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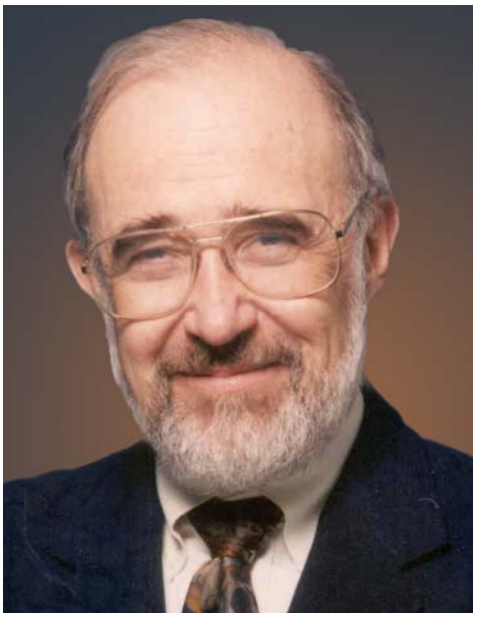

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On 7 November 2004, Dr. Kenneth Olden received the highest award in public health, the Sedgwick Medal, given by the American Public Health Association (APHA). The accompanying news release simply stated that "Olden was selected because of his extraordinary achievements in linking environmental health sciences with public health" (APHA 2004).

My approach to discussing what Dr. Olden has done to deserve this prestigious award is of necessity anecdotal. It is beyond my capabilities to do justice to the broad sweep of ideas and accomplishments that fit within the rubric of public health and that are among the defining features of the National Institute of Environmental Health Sciences (NIEHS) under Dr. Olden's leadership. Working with many of his colleagues, including Samuel Wilson, Anne Sassaman, Allen Dearry, Christopher Schonwalder and William Suk, Olden has elevated public health conceptually and organizationally within the NIEHS and has shown the way for the entirety of the National Institutes of Health (NIH).

The often fuzzy definition of the terms complicates considering the nexus between public health and NIEHS activities. The distinguishing word of the designation National Institute of Environmental Health Sciences is the term "environment." It is not a very precise term. All of us with any seniority in the field have wasted far too much time at committee or organizational meetings trying to define "environment" in the context of the particular charge to the group. The broadest definition is that "environmental" can mean everything that is not genetic. Obviously, such a broad definition of the purview of the NIEHS would be unreasonable, as well as unacceptable to other NIH institutes and other federal agencies.

Defining NIEHS in relation to public health is probably done best through understanding its history

Concurrent expansion of academic and community programs in environmental public health are both a testimony to the impact of Dr. Olden and a harbinger of continued growth in the field.

and its "market." The NIEHS was formed in response to the nation's growing concern about the risks of chemical and physical agents in the environment. It differed from other major NIH components in two major ways: it was located a significant distance from the main NIH campus in Bethesda, and it was the first to distinguish itself from the National Institute of Medical Sciences by an appellation that had no well-recognized organ system, disease complex, or health discipline.

Dr. David Rall, Olden's predecessor, recognized that it was crucial that environmental health sciences be seen as achieving scientific expertise equivalent to that of other national institutes of health. That level of respect was required to build a stronger, enduring NIEHS that could then be expanded to encompass broad public health goals.

Lead poisoning was one of the few disease-related areas that could be seen as clearly within the purview of NIEHS among NIH institutes. NIEHS activities in this area were exemplary, demonstrating how the institute distinguished itself not only from other NIH components but also from the U.S. Environmental Protection Agency (U.S. EPA) and the Centers for Disease Control and Prevention, all of which have contributed significantly to the marked decrease in blood lead levels that has been such a major public health advance. The role of the NIEHS was notable for continuing to fund basic science related to the health effects of lead after interim regulatory action had been accomplished. The resulting research findings reopened questions about the toxic effects of low levels of lead, which produced more stringent regulations, including the complete ban of lead from gasoline. Without the persistence of the NIEHS after the regulatory organizations had moved to other issues, these further regulatory efforts would likely have been much delayed.

However, were NIEHS to restrict its disease-related activities to lead poisoning and a few other disease entities clearly related to environmental pollutants, the NIEHS would not have the breadth of most other NIH institutes, for which diagnosis and treatment of major diseases are appropriate research subjects. Increasing the breadth of the NIEHS to encompass public health has provided a rationale for growth and competitiveness for resources that has been controversial, particularly as public health and prevention have not been the major focus of the NIH. Olden has pointed out that the emphasis on prevention and public health has been an impediment to garnering attention for environmental health sciences from medical researchers and the public (Olden 2004). Those of us in the public health field often have suggested that a more accurate name for the NIH is NIM, the National Institutes of Medicine—the distinction being that health is defined as not merely the absence of disease but the complete well-being of the individual.

The field of public health also is not clearly defined but certainly includes an emphasis on population-based approaches to the prevention and amelioration of human disease, and the promotion of well-being and health. Schools of public health are the only academic institutions in the United States that must teach environmental health for their accreditation. The practice of classic environmental public health has been highly successful: infectious disease appeared to be brought under control through advances in sanitary engineering that delivered clean water and safe food, and vector-borne diseases were markedly decreased (Gochfeld and Goldstein 1999; Gordon 1999). The

effectiveness of the often unseen activities of environmental public health sanitarians unfortunately led to a loss of investment in the research infrastructure needed to address the seemingly new problem of the unwanted impacts of our chemical era. The re-emergence of environmental health occurred largely divorced from its roots in public health, leading to an unfortunate gulf that is mirrored in the emergence of separate national, state, and local agencies responsible for the regulation of chemicals and the natural environment (Burke et al. 1997; Goldstein 1995). Reconsideration of the unity of health and the environment has begun to narrow that gulf, and the NIEHS under Olden has been heavily involved.

A problem central to population-based studies can be described loosely as a lack of power to detect cause-and-effect relationships, especially when these are due to long-term exposures to relatively low levels of environmental agents (Hulka and Wilcosky 1988). A key effort of the NIEHS has been in developing and using biomarkers as a means to improve population-based studies of the effects of both synthetic and natural environmental components and to more readily translate these findings into environmental controls (Goldstein and McMenamin 1998; National Research Council 1989). The goal is to close the gap between observations in experimental systems and public health (Schonwalder and Olden 2003). Biological markers are often divided into those reflecting exposure, effect and susceptibility (National Research Council 1989). Conceptually, the use of biological markers permits linking exposure and effect, particularly in susceptible populations, thereby greatly increasing the power of epidemiology to detect cause-and-effect relations and to validate experimental exposures. Biological markers are also highly useful tools for studies of interventions aimed at protecting the public. New technologies associated with the unraveling of the human genome, including molecular, computational, and structural biology, have much to offer human population studies (Waters et al. 2003a, 2003b).

The emphasis on population-based approaches has also resulted in specific NIEHS initiatives related to the impact of the environment on children's health, women's health, and the health of disadvantaged populations (Dearry et al. 1999; O'Fallon et al. 2000; Olden and Guthrie 2000; Olden and Newbold 2000). Populations have also been defined in terms of chronic diseases such as Parkinson's disease and asthma, with the goal of attempting to elicit the role of the environment in causation or exacerbation (Olden et al. 2002)

I emphasize that there is much overlap between basic research and environmental public health. In fact, some of the major preventive approaches in environmental health have been the result of basic research. A prime example is the Ames test, which was developed on the foundation of understanding the basic science of mechanisms of mutagenesis and of the role of mutations in cancer. The routine use by the chemical industry of the Ames test and related short-term tests for mutagenesis as part of new product development has undoubtedly prevented the release of carcinogenic chemicals into the environment. Under Olden's leadership, the NIEHS has made a major investment in bringing in the new generation of preventive tests through the National Center for Toxicogenomics (NCT)—again linking newer advances in understanding mechanisms of action to predict the toxicity of chemicals. Of note is that Olden has consistently phrased the rationale for NIEHS investments in the NCT or in the Environmental Genome Project in terms of public health (Olden and Guthrie 2001; Olden et al. 2001, 2004; Waters et al. 2003a, 2003b).

In this sense, mechanistically oriented toxicology is a public health discipline through providing the scientific basis for primary preventive actions and for risk analysis of existing threats, as well as through safety assessment of chemicals. The activities of the National Toxicology Program, which is directed by Dr. Olden as head of NIEHS, have been particularly notable for developing new mechanism-based approaches that permit it to extend the field of safety assessment of chemicals.

NIEHS Centers Community Outreach and Educational Program

The NIEHS centers Community Outreach and Educational Program (COEP) has in many ways been the flagship of the NIEHS. We previously reported that larger programs in environmental health science tended to be located at universities that had both an NIEHS center and a public health education program, suggesting the value of academic public health to environmental health sciences (Goldstein et al. 1998). Perhaps nothing better demonstrates the breadth of the NIEHS under Olden than the change requiring the NIEHS centers COEP to include community outreach.

My own experience is one of initially hiding environmental outreach programs from the NIEHS, and then having these same programs be considered exemplary. In 1980, in response to the outcry of its citizens about the state's many environmental problems, New Jersey invested in developing cooperative environmental health science programs at both Rutgers University in Piscataway, New Jersey, and the then Rutgers Medical School. Our aspirational goal was to achieve the stature of an NIEHS center, partly as a means of benchmarking whether we had succeeded in developing the strength of science responsive to the needs of New Jersey. We also set out to develop outreach programs that would translate our science for public needs. Our goal was to educate New Jersey residents about environmental health issues that at the time were consistently voted to be the number one issue in the state. By 1986, hoping that we had achieved a scientific track record that could make us competitive for an NIEHS center, we assembled an outside group of experts to review our programs and advise about this possibility. The external group was highly positive about our toxicology, advised us to be careful in describing our activities in exposure assessment, and warned us not to tell the NIEHS about our outreach programs, including a pioneering K–12 educational program under Audrey Gotsch. Under Olden's leadership, the NIEHS centers COEP began its current absolute requirement for outreach activities. Instead of being seen as a distraction from the scientific mission of the NIEHS, COEPs are now seen as having the important role of ensuring that environmental health sciences are responsive to public need. The individual centers have a wide latitude in defining their communities and outreach programs. The geographical range can be statewide or local; for example, the University of Iowa center in Iowa City, Iowa, focuses on rural health statewide, and the Columbia University center in New York City focuses on inner city environmental issues in Harlem. The focus can be highly specialized, as in the University of Medicine & Dentistry of New Jersey center in Piscataway, which concentrates on K–12 teachers and students, or the Harvard center in Cambridge, Massachusetts, which focuses on health professionals. More recently, the NIEHS has developed a centralized resource center to make available online the various outreach and educational materials developed and used by all the COEPs (NIEHS 2005). Evidence of a successful COEP that can link the NIEHS center researchers with some aspect of their community is now a necessity for NIEHS center funding.

Outreach activities to the community ideally go in both directions, not only informing the community but also providing feedback to researchers about issues of concern that could be the subject of investigation. One innovative approach to increase the likelihood of this interaction has been the development of town meetings in various parts of the country, often organized through local NIEHS centers. Olden's personal participation in these meetings has emphasized the importance to the NIEHS of listening to public concerns about environmental health.

A key element of public health is the response to disasters. NIEHS centers in the New York City area responded rapidly with expertise to the immediate and long-term challenges of the 2001 terrorist attack on the World Trade Center.

Multidisciplinary Approaches and Public Health

Public health is inherently multidisciplinary and collaborative—a common mantra being that there are no major public health problems that can be solved by any one discipline working alone. NIEHS efforts that contribute to investigators and lay people understanding the threat of chemical and physical agents have certainly facilitated protection of the population as a whole, especially groups sensitive to these agents, while increasing the breadth of disciplines involved in environmental health. Of note has been the growth of the NIEHS intramural program in epidemiology, a necessary component of a broad public health approach to environmental disease. Also of note has been the continuation and expansion of the tradition of collaboration with government and industry (Olden 1995b).

During Dr. Olden's tenure, there has been an emphasis on the interaction of multiple chemical exposures in causation of disease—an approach particularly evident in the program involving Superfund centers (Suk and Olden 2004). The Superfund Basic Research Program centers are an excellent example of a public health approach in which basic science is brought to bear on a specific public health issue. These centers were begun under David Rall when Congress finally recognized that it required more than a pick-and-shovel approach to clean up our nation's improperly

disposed hazardous waste. They typify public health in their multidisciplinary approach that usually incorporates both engineering and ecology into the scientific and technical components of the programs. Of particular note has been the emphasis on understanding the effects of exposure to multiple chemicals under scenarios consistent with actual exposures relevant to public health (Suk et al. 2002; Suk and Olden 2004). As an indication of congressional satisfaction, the number of these centers has expanded, and they now are funded directly into the NIEHS budget rather than as an U.S. EPA pass-through.

Environmental Justice

The movement of the NIEHS into public health issues inevitably led to a major involvement in the area of environmental justice, which was brought to prominence by a coalition of different organizations, including civil rights groups and environmental organizations. Major credit for bringing this to the forefront was some excellent work done by the Church of Christ under the leadership of Charles Lee, as well as by Robert Bullard, Michael Greenberg, and their colleagues (Bullard and Wright 1993; Greenberg 1999; Greenberg and Cidon 1999). Following President Clinton's 1994 Executive Order on environmental justice (Clinton 1994), Lee moved to the U.S. EPA to lead its regulatory and programmatic efforts in this area (Lee 2002). Quite appropriately, Olden began to develop a research agenda (Sexton et al. 1993) that included funding an Institute of Medicine committee to help set the agenda (Institute of Medicine 1999).

The salience of environmental justice considerations to the NIEHS research mission is clear from three indisputable points: in disadvantaged communities, pollution levels tend to be higher; in these communities, the average level of health is poorer; and individuals with poor health tend to be more susceptible to the effects of environmental agents (Cutter 1995; Rios et al. 1993). Research programs focusing on uncovering cause-and-effect relationships are far more likely to be successful in those communities where the pollutant levels are highest and the susceptibility is greatest. Strategically, our national environmental health research effort should be focused on those communities in which there is also the greatest concern about environmental justice. Under Olden's leadership, this research effort has begun—but much more work is necessary to build on this base.

NIEHS funding in this area was notable for an innovative series of research grant programs that required close collaboration with the community for funding. The result has been the development of working relations between community organizations and academic environmental research groups. This is needed to overcome the legacy of the Tuskegee experiments, as well as often less than cordial relations between academic centers and minority communities, which have built much distrust of research among African Americans and other minority groups (Thomas and Quinn 2000)

Community Interaction

The extent of interaction of a university with its community on research activities can be described as occurring on three levels. The most superficial is simply to inform members of the community about pertinent research in which they are involved before they read about it in the newspapers. At the second level, attempts are being made to actively involve the community through such approaches as advisory boards and hiring local people. The deepest level is a true partnership in which the community participates in setting the research agenda. To achieve this level requires ongoing dialog between local stakeholders and the research community, with the research community willing to invest in answering questions of importance to the community, while respectfully explaining why science does not have the power to answer certain community questions.

Under Kenneth Olden, the NIEHS has developed innovative funding mechanisms that have led the way among other NIH components in producing mutually beneficial interactions between communities and academia. O'Fallon and Dearry (2002) of the NIEHS have described six principles of community-based participatory research: promote active collaboration, foster co-learning, ensure projects are community-driven, disseminate results appropriately and usefully, ensure research and intervention strategies are culturally appropriate, and carefully define and identify the community. They and their NIEHS colleagues have also described the strategic approach to set a research agenda responsive to community needs (O'Fallon et al. 2003).

Toxicogenomics and Public Health

The importance of toxicogenomics to environmental health sciences, and the leadership of NIEHS under Ken

Olden and Sam Wilson in establishing this new field (Wilson and Olden 2004), will be covered elsewhere in this special issue of *Environmental Health Perspectives* (*EHP*). Although toxicogenomics is usually studied as a subfield of molecular biology, it also has a strong public health component, and many of the active programs in this area are in the schools of public health. Simply stated, much of the power of the new genomics will be applied to unraveling the underlying cause of relatively small risks in relatively large populations. Central to public health are interventions that affect the health and well-being of populations, particularly those that are susceptible. Coupling genomics with proteomics and metabolomics provides the opportunity to decipher cause-and-effect relationships in ways that previously have not been possible. Particularly of note is the possibility that the new molecular biology can lead to a completely different way of looking at the human health impact of chemical agents. Rather than starting with a chemical and asking whether it causes health effects, the new biology should permit us to work backward from adverse effects in humans to causal agents (Goldstein 2000).

Risk Assessment

Risk assessment has always been a difficult issue for the NIEHS. Although seen as a basis for regulatory approaches to protect public health and the environment, it is also firmly based on science that is often provided by the research activities of the NIEHS. The importance of risk assessment has been clearly recognized by the U.S. EPA Office of Research and Development, which has reorganized its laboratories around the risk paradigm. Olden put his own stamp of approval on risk assessment, recognizing early in his tenure that the NIEHS had a responsibility to improve the science on which risk assessment is based (Olden 1993; Olden and Klein 1995). More recently, he has focused biotechnology-based NIEHS initiatives, such as the Environmental Genome Project and the NCT, on improving risk assessment methodology, and has chosen to publish this "bold new direction for environmental health research" in a public health journal (Olden et al. 2001).

The hazard identification and dose–response steps of risk assessment are clearly within the purview of the NIEHS. In its broadening approach to risk assessment, the NIEHS also has become more interested in exposure assessment. This is a quintessential public health aspect of the risk paradigm: understanding the pathway of exposure permits interdiction. Quantifying human exposure also is the starting point for evaluating the usefulness of biomarkers of exposure or effect. Exposure assessment also enables the evaluation of genetic polymorphisms responsible for determining why individuals with identical levels of exposure have different degrees of target organ toxicity. Newer risk concepts, such as aggregate and cumulative risk, depend heavily upon exposure assessment (Goldstein, in press). Similarly, the characterization and the communication of risk have become greater concerns to the NIEHS, including aspects of cultural determinants of the understanding of risk. Olden has been particularly interested in the importance of education in facilitating understanding of environmental risks (Olden 1995a).

Global Health

Perhaps no better example exists of the need for the entwinement of public health and environmental research than the challenges of global environmental health (Goldstein 2000; Smith 1993). An obvious example is global warming. The U.S. leadership in the production of carbon dioxide (but not other greenhouse gases), our unwillingness to participate in the Kyoto Accords, and the skepticism in some of our political quarters about the scientific basis for predicting global warming have all combined to produce an appearance of a smug and greedy overuse of the earth's resources and a negative international stature on this important issue.

The U.S. taxpayer has expended significant funding over many years on the physical sciences research needed to predict the relation of greenhouse gases to climate changes on global and regional levels. Unfortunately, we have done very little until recently to answer the "So what?" question that must be addressed if we are to convince the public that unpopular steps are necessary, such as raising gasoline prices or other limitations on our activities. Fuel oil taxes tend to be regressive because they fall most heavily on the poorest Americans. Similarly, although almost everyone will regret the loss of coral reefs as a consequence of ocean warming, this may be more of a concern to our elites than to the average American. Yet very little research has focused on understanding the public impact of global climate change until the NIEHS

in 1989 held a conference specifically on "Global Atmospheric Change and Research Needs in Environmental Health Sciences" (Goldstein and Reed 1991). Much has been done since to study issues identified at the conference. These issues range from the specific toxicology of replacement chlorofluorocarbon chemicals to the role of habitat changes induced by global climate change in the spread of infectious diseases (Patz et al. 2004).

The issue of the environmental causes of emerging and re-emerging infections extends well beyond global climate changes (Morens et al. 2004; Patz et al. 2004). Fifty years ago experts confidently predicted that the defeat of infectious disease was imminent. Advances based upon sanitary engineering leading to improved water supplies, new antibiotics for age-old scourges, the polio and measles vaccines, and the eradication of smallpox all suggested that infectious disease was no longer a major problem. But this feeling of triumph has now been replaced by one of dread because of emerging and re-emerging infections such as HIV (human immunodeficiency virus), SARS (severe acute respiratory syndrome), Ebola virus, dengue hemorrhagic fever, and resistant tuberculosis. Of note has been the increasing recognition of an environmental component in many if not all of these emerging and re-emerging infectious diseases. Olden's support of efforts to promote the unity of health and the environment are highly pertinent to effective research aimed at understanding and mitigating these global issues. The activities of Terri Damstra and of Christopher Schonwalder representing the NIEHS internationally and fostering collaborative global health research have been particularly noteworthy, although this global portfolio in cooperation with partners around the world must grow if the NIEHS is to maintain its cutting edge.

The Built Environment

The broadening of the NIEHS mission to extend beyond the impact of environmental chemical and physical agents is nowhere more evident that in its consideration of the built environment (Srinivasan et al. 2003). This is now a "hot" topic, with major conferences, funding from organizations such as the Robert Wood Johnson Foundation, and an expanding research portfolio. The NIEHS has been in the center of this activity. An illustration of the role of the institute is evident in the consideration of research on urban sprawl that has expanded into the broader issue of obesity and diabetes.

Some of the earliest work on the broad environmental consequences of suburban sprawl came from Michael Greenberg and his colleagues in New Jersey (Greenberg 1999; note my bias: I was one of Greenberg's colleagues, although not for this research). New Jersey's demography is the definition of sprawl. As a state it leads the country both in population density and in having the smallest percentage of its overall population in its largest city. The very nature of the sprawl inevitably led to population being in proximity to the effluents of its national leading chemical, petrochemical, and pharmaceutical industries. This focus on chemical effluents and waste led the public to be little prepared or concerned about the seemingly less dramatic environmental impacts of sprawl. Yet a major cause of automotive emissions in New Jersey was the ever-increasing traffic density, with a lengthening rush hour of more and more automobiles and trucks in inefficient stop-and-go traffic patterns. Additional roads to relieve congestion often led to more suburban housing and even further traffic problems.

But this work languished for lack of national interest. More recently, work in Atlanta, Georgia, has very effectively moved this issue into the focus of the public and the research community (Frumkin 2002, 2003; Frumkin et al. 2004). Of signal importance has been the addition of the issue of obesity and diabetes—both of which are increasing in epidemic proportions (Frumkin et al. 2004). The NIEHS has been active in sponsoring meetings on the subject and on drawing attention of researchers to this important problem.

The Role of Environmental Health Science in Addressing the Evolution of Environmental Control Strategies

A public health approach to environmental health science is particularly needed for future progress in environmental control strategies. A consistent theme of U.S. EPA administrators of both political parties has been to move the regulatory focus from "command and control" to more sophisticated regulatory techniques that focus on end results. The command-and-control approach is typified by regulatory dictates to decrease end-of-pipe air and water emissions on major sources. This relatively inflexible legalistic approach has been highly successful in cleaning up pollution that visibly

dirtied our air and water. However, investigators are now recognizing the need for more sophisticated approaches to deal both with residual pollution that is still producing significant adverse effects, and with the more complex issues affecting health and the environment. The challenge of nonpoint sources, the higher costs of wringing out even further emissions from single point sources, the appreciation of the relative importance of indoor compared with ambient sources, the recognition of the salience of sprawl and other locally controlled issues, and the increasing importance of air pollutants, such as particulates and ozone, and water pollutants, such as nitrogen, for which the controllable sources are not always obvious—these are just a few of the reasons that the initial faith in command-and-control regulatory approaches has been called into question. Meeting these new challenges requires a public health approach (Goldstein 1995), including an enhanced scientific capability to measure exposure in the target human or ecosystem rather than at the end of the pipe, a better understanding of the relation between external dose and target organ toxicity, and translation of advances in analytical chemistry and molecular biology to develop better biological indicators of exposure, effect, and susceptibility. Unfinished regulatory business remains heavily dependent upon NIEHS-based risk science—an example being the failure to deal appropriately with oxygenated fuels and other gasoline additives—and re-emerging issues such as those related to water use in the face of dwindling reserves have implications for NIEHS research (McQuigge 2002)

One of the more interesting potential challenges to standard environmental regulatory approaches in recent years had been the precautionary principle. The description of this principle, and its initial adoption, comes from Europe. Although highly controversial, it is now affecting issues as wide ranging as world trade decisions and purchases by the City of San Francisco. Of particular note is the European Union's Registration, Evaluation & Authorization of Chemicals (REACH) proposal, now making its way toward adoption by the European Union. It is based partly on precautionary approaches that clearly shift the burden of proof from government to industry, which must show that a new or existing chemical will not be a problem. Among its distinctions from the Toxic Substances Control Act (1976) is greater emphasis on requiring toxicological data for new chemicals and more focus on existing chemicals. This precautionary approach is good public health because it represents primary prevention—not allowing the problem to occur in the first place. The issue, however, is complicated by suspicions related to the propensity of the European Union to use the precautionary principle for purposes of erecting protectionist trade barriers, and a tendency toward shortcuts that bypass good science (Goldstein and Carruth 2003a, 2003b).

Two additional indicators of the broadening of the NIEHS definition of environmental health sciences to include public health are the Presidential/Congressional Commission on Risk Assessment and Risk Management and the Institute of Medicine's Environmental Health Sciences Roundtable. The commission was called for in the Clean Air Amendments of 1990 (Clean Air Act 1990) to help clarify the role of risk assessment and risk management in the broad range of environmental health activities. It was chaired by Gilbert Omenn, then dean of the University of Washington School of Public Health, and included David Rall and John Doull among its 10 members chosen by the President, congressional leadership, and the head of the National Academies. The commission's broad view of environmental health was most notably expressed in a new six-part *Framework for Risk Assessment and Risk Management* (The Presidential/Congressional Commission on Risk Assessment and Risk Management 1997), which put risk assessment in context of the public health problem it was addressing and called for concerted efforts to both involve stakeholders and use scientific approaches to evaluate the impact of any resultant actions.

Similarly, the actions of the Institute of Medicine's Environmental Health Sciences Roundtable is further evidence of the broadening definition of environmental health. This roundtable convenes representatives of governmental agencies, industry, citizen groups, and academia to meet regularly and initiate activities related to environmental health. It is co-chaired by former Congressman Paul Rogers, and by Lynn Goldman of Johns Hopkins School of Public Health, who was the U.S. EPA official involved with the risk commission. Both Dr. Olden and the deputy director of NIEHS, Samuel Wilson, have been active contributors to this effort. The unity of health and the environment has been the dominant theme of the many activities initiated by the roundtable. Workshops and regional

meetings have been held on topics as divergent as the challenges of nanotechnology, gene–environment interactions in cancer, rural environmental health (Meit 2004; O'Fallon and Dearry 2001), postindustrial environmental challenges, urban sprawl, responding to disasters, and the role of environmental factors in premature birth (Institute of Medicine 2001). These topics, and others such as endocrine disruptors, persistent compounds derived from personal use (Daughton and Ternes 1999) the precautionary principle (Goldstein and Carruth 2003b), improved bioindicators of environmental health effects, the resurgence of concern about water pollution in the context of growing water shortages (McQuigge 2002), and the early detection of the environmental impact of new technology and of terrorist threats (Goldstein 1993; Goldstein and Reed 1991), all present challenges that require a vibrant NIEHS that continues to wrestle public health benefits from the advancing frontiers of science.

Environmental Health Perspectives

Finally, any discussion of the public health impact of the Olden years would be remiss if it did not emphasize the major change in *EHP*, the NIEHS journal under the journal's able editorial leadership. *EHP* has greatly increased its impact factor, indicating the strength of the science it attracts and publishes, and it has developed a sprightly series of special papers and readable journalistic reviews of important issues. Its benevolent distribution policies have led it to be disseminated worldwide. The net result is that an excellent but only narrowly relevant scientific journal has been transformed into a major means of multidisciplinary communication across the many basic and applied sciences and across the many national and international cultures relevant to environmental health. *EHP* is a truly remarkable example of the importance of the context and distribution of good science as a means to positively affect public health.

Summary

Dr. Kenneth Olden has led an expansion of the breadth of the National Institute of Environmental Health Sciences (NIEHS). A major emphasis on public health has been evident in the concepts being used to frame NIEHS efforts and in groundbreaking initiatives in areas as diverse as environmental justice, the built environment, exposure assessment, and risk assessment. Concurrent expansion of academic programs in environmental health are both a testimony to the impact of Dr. Olden and a harbinger of continued growth in the field. Congress and the public are increasingly insisting on a return on the investment that has recently doubled the budget of the National Institutes of Health, and the importance of prevention and of public health has been made even more evident by issues ranging from the response to terrorism to the obesity epidemic and the problem of childhood and adult asthma. The continued nexus with public health will ensure a vibrant NIEHS.

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Notes

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