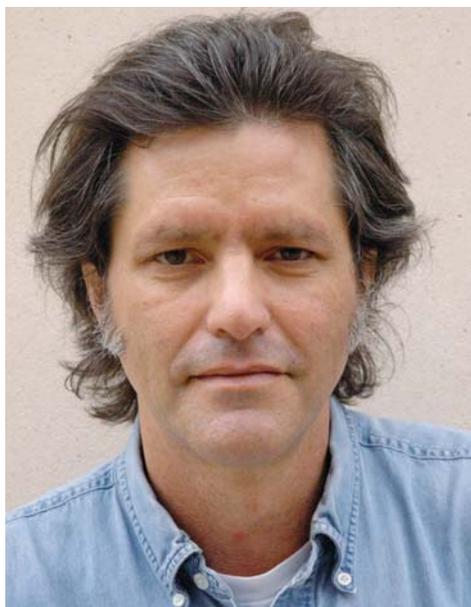


Environmental Justice, Science, and Public Health

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Since coalescing in the 1980s, the environmental justice movement has become one of the many forces influencing public health conditions and environmental health science. Shaped by principles of civil rights, democracy, and opposition to colonialism, environmental justice advocates echo an older and broader push to consider population health an issue of social justice, not merely the absence of disease in individuals. Linking American Indian and other non-European cultures' respect for a natural world in which the human species is only a dependent part, with principles of sustainability, self-determination, and cultural integrity, environmental justice advocates have insisted that environmental quality itself is an issue of social justice (Bullard 1993).

Knowledge in environmental science and medicine reflects the needs, interests, and perspectives of professionals, the business community, and government agencies that support research (Wing 2002). These institutions shape the choice of questions, research designs, and cultural norms regarding interpretation of data and public health implications (Wing 1998). Facing the routine use of science by institutions that create and regulate environmental hazards, the environmental justice movement has sought scientific documentation about exposures and health conditions that reflects the values and needs of affected communities. Environmental, social, and medical scientists have responded with empirical research that is driven by community concerns related to contamination, health, and justice. The development of partnerships and programs of support by private and government agencies, notably the National Institute of Environmental Health Sciences (NIEHS) Environmental Justice: Partnerships for Communication extramural grant program, started under the leadership of Dr. Kenneth Olden, brings prospects

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both for positive transformation of science and health and for retrenchment and reinforcement of existing inequities.

In this article, I argue that what has been called “a science of environmental justice” (U.S. Environmental Protection Agency (U.S. EPA) 2004), a science that can serve as a knowledge base for public health advocacy, cannot develop without revolutionary changes in both science and society. The developing science of environmental justice could become accommodated to production and maintenance of global environmental injustice, or it could promote efforts to reduce injustice and promote sustainability. A historical perspective on the determinants of public health and research about improvements in public health helps to place prospects for a science of environmental justice in perspective. I begin by considering inattention to popular struggles for health and justice in scientific accounts of the causes of declines in mortality and improvements in life expectancy in Europe and the United States during the 19th and 20th centuries.

The Role of Popular Movements in Epidemiologic Transition

Although the environmental justice movement emerged recently, the social relations that create racial and economic disparities in health and environmental conditions, the struggles against those disparities, and the scientific study of the causes of determinants of health have a long history. Prospects and challenges for creating a science of environmental justice that can contribute to improved public health are evident in this history.

The term “epidemiologic transition” was introduced at about the time when the 20th century epidemic of

coronary heart disease (CHD) was near its peak in the United States, cancer rates were increasing, and new and re-emerging infectious diseases were not yet widely recognized as public health problems in the West (Omran 1977). Epidemiologic transition was proposed as a description of the West’s shift from a health profile dominated by infectious diseases to one dominated by noninfectious diseases.

Mortality studies formed the basis for documenting epidemiologic transition and evaluating its potential causes. Death rates are a crude way to evaluate the state of public health. However, where there are legal requirements for death registration, certification of causes of death, and participation in population censuses, death rates provide a quick and empirical way to evaluate how public health conditions vary over time and place. They also provide clear evidence that environmental changes are powerful determinants of population health over a time span when genetic change is minimal. Beginning in the middle of the 19th century, death rates dropped markedly in the West as infectious pandemics receded and mortality from common infectious diseases declined. Age-adjusted mortality trends for England and Wales are shown in Figure 1 (McKeown 1979).

The mortality decline coincided with the revolution in microbiology brought on by discoveries of Koch, Pasteur, and others in the second half of the 1800s and the rise of scientific medicine in the 1900s. The prestige of medical and public health science grew rapidly as pathogens were identified, vaccines and antibiotics were developed, and the complex ecological relationships between environmental conditions, disease vectors, and human hosts were described. Therefore, it was almost medical heresy when medical historians and

demographers proposed that medicine had little to do with the decline of those very diseases best understood by medical science. Carefully reconstructing mortality trends through changes in disease definitions and diagnostic methods (McKeown and Record 1962), McKeown (1979) estimated that approximately three-quarters of the improvement in mortality rates in England and Wales between 1848–1854 and 1971 was due to declines in infectious disease mortality and found that most of this decline occurred before the introduction of effective preventive or curative measures. For example, respiratory tuberculosis accounted for 17.5% of the fall in total mortality in this period; however, as shown in Figure 2, 86% of the decline occurred before introduction of streptomycin in 1947 (McKeown 1979). A similar pattern has been documented in other European countries (McKeown et al. 1972) and the United States (McKinlay and McKinlay 1977).

So what caused the recession of infectious diseases if not advances in medical science and access to care? McKeown and others argued that the most important causes were improved nutrition, sanitation, and declines in the birth rate. These factors limited the spread of water- and foodborne agents, reduced crowding, and increased host resistance. In this view, the

decline of infectious diseases in the West had more to do with widespread improvements in environmental conditions that affect most of the population, preventing the spread of disease and decreasing susceptibility, than with specific medical services offered to individuals one at a time, primarily after they become sick. From this classic public health perspective, the work of sanitary engineers, food scientists, and industrial hygienists deserves at least as much credit for health transformation as does the work of medical scientists and medical practitioners.

In 1900 the leading cause of death in the United States was tuberculosis. By 1940 it was CHD. As measured by death rates, the CHD epidemic peaked in this country in 1968 (Stallones 1980). In 1978 epidemiologists, demographers, and physicians met at a conference on the decline of CHD convened by the National Heart Lung and Blood Institute to consider the causes of the decline (Havlik and Feinleib 1979). In some respects their debate (Levy and Moskowitz 1982) was parallel to the arguments over the role of medicine in the decline of infectious diseases. Proponents of the role of medical care focused on improvements in emergency medical services, cardiopulmonary resuscitation, coronary bypass surgery, and new pharmacologic

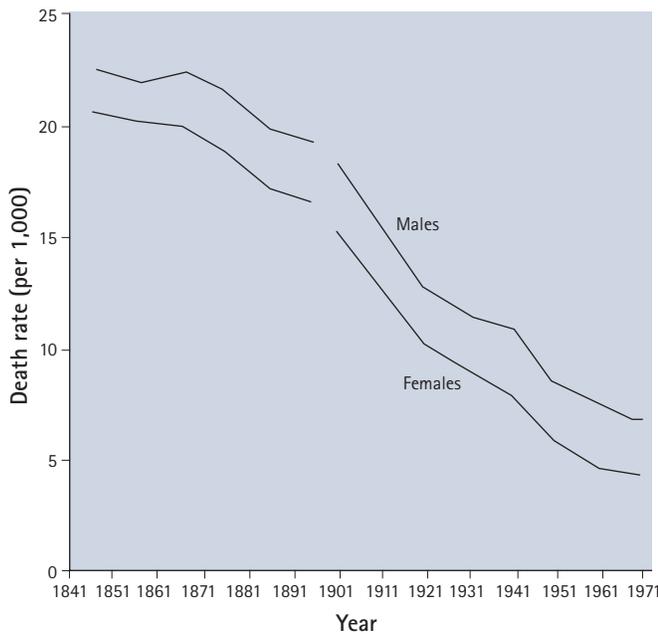


Figure 1. Age-adjusted death rates: England and Wales. Reprinted from McKeown (1979) with permission from Princeton University Press.

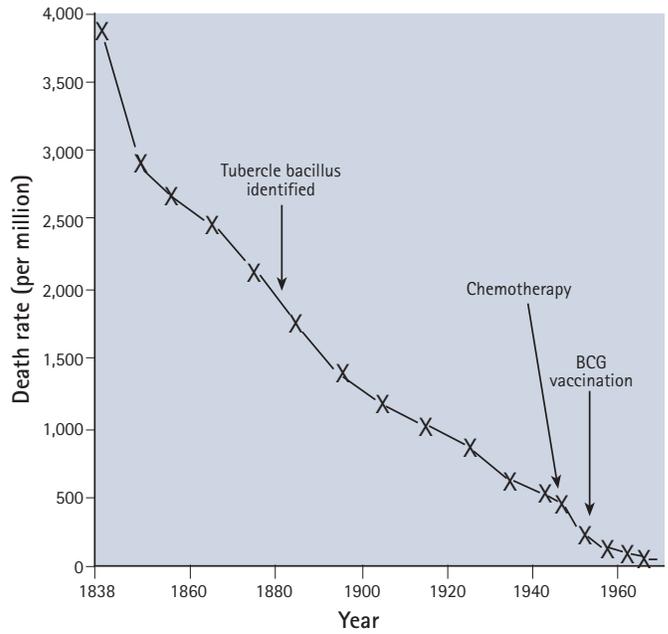


Figure 2. Age-adjusted death rates for respiratory tuberculosis: England and Wales. Reprinted from McKeown(1979) with permission from Princeton University Press.

agents, whereas public health scientists cited changes in diet, exercise, and smoking (Figure 3). Similar arguments were made about declines in stroke mortality. Beginning in the early 1960s, only a few years after the publication of the first randomized trials showing antihypertensive therapies to be effective in reducing incidence of stroke among patients with severe hypertension, and 40 years after the onset of the decline of stroke mortality in the United States, arguments that stroke mortality declines were caused by hypertension treatment began to appear in the medical literature (Howard 1965; Wing 1984). The belief that antihypertensive medications have been responsible for declines in stroke mortality persisted despite evidence to the contrary (Bonita and Beaglehole 1989; Casper et al. 1992).

Debates over the causes of the rise and fall of the major diseases in populations reveal the profound

influence of scientific and popular cultures in shaping directions of inquiry and explanations of health. The mainstream debate over causes of declines of infectious and cardiovascular disease mortality pits proponents of increased funding for medical sciences and access to clinical services against proponents of increased funding for environmental science, pollution prevention, food safety, health education, and the search for new risk factors. Our scientific values, which privilege evidence from controlled experiments over evidence from observations of complex ecological systems, lead to a preference for specific biomedical explanations of complex public health phenomena. Arguments for the role of medicine are reinforced by its social prestige; high cost; the distress, needs, and vulnerabilities of sick patients; and a cultural individualism (Tesh 1988). On the other hand, competing public health explanations have gained

substantial scientific credibility through careful observational research and application of interventions based on understanding of etiologic mechanisms. However, both medical and public health arguments share the implication that the most important causes of declining disease rates are factors over which professionals have control and responsibility. From both perspectives, credit for improvements in public health largely accrues to the scientists and practitioners who see themselves as responsible for assembling basic scientific knowledge and applying that knowledge through engineering design, public policy development, and provision of drugs, surgery, health education, and other clinical services. Although socioeconomic improvement has been included as an

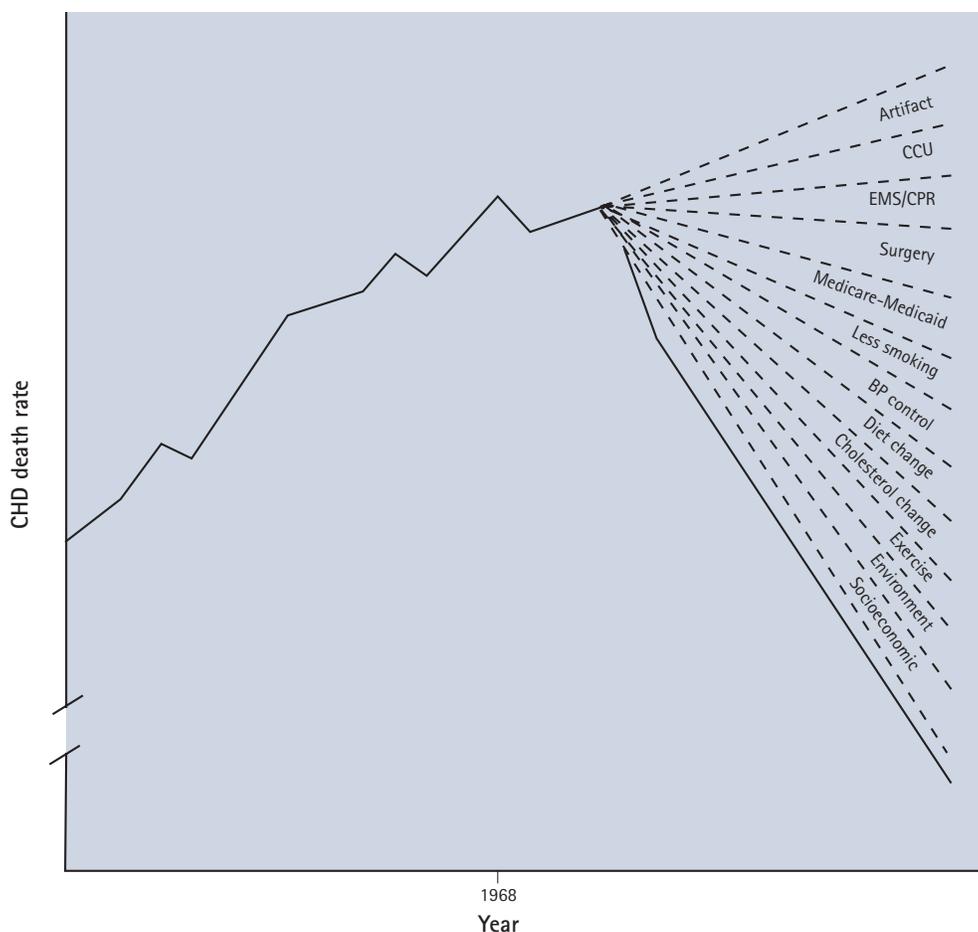


Figure 3. The rise and fall of CHD: United States, 20th century. Can we identify factors causing the coronary mortality decline and measure their contribution? Reprinted from Havlik and Feinleib (1979)

explanatory category in discussions of the decline of both infectious (McKeown 1979) and noninfectious (Armstrong et al. 1998; Havlik and Feinleib 1978) diseases, it has been considered primarily as a consequence of the proper management of poverty by professionals responsible for the economy and living conditions, a public health tradition since the 1840s (Hamlin 1995).

Left out of this picture of the determinants of health improvement is the role of the majority of people who have less education, less income, poorer living conditions, and poorer health than that of scientists, medical practitioners, and other professionals. Omission of this population from scientific analysis of the causes of epidemiologic transition and improved population health perpetuates the perception that they have little understanding of health and little ability to initiate positive changes on their own. However, reductions in pollution, better housing, safer working conditions, a more nutritious and varied diet, and improved educational opportunities are not simply services brought to people who do not know enough to seek them on their own. Popular movements for improved environmental, occupational, and living conditions existed throughout the historical period of the recent epidemiologic transition. The academic literature documents the support these movements received from some professionals (Fee and Brown 2005; Tedeschi et al. 2003; Waitzkin 1981); however, the role of laborers, the rural poor, the colonized, and people subjected to racism and sexism—those who are most affected by poor housing and sanitation, unsafe working conditions, lack of educational opportunity, and low income—has received little attention (Cooper et al. 1981). Professionals not only have little exposure to struggles for labor and civil rights but are also in a conflicted position when they work for or with institutions that benefit from a system in which poor living conditions and low wages create privilege and profit by reducing costs of labor, services, and pollution prevention. Those who lack basic conditions necessary for good health, including safe housing, air, water, nutrition, working conditions, and access to medical care, are ultimately the same people who organize to bring themselves better health conditions. Unlike professionals, for whom these conditions may be merely a subject of intellectual and occupational interest, community members must choose to endure

passively or to engage in a struggle for change. This is the basis of the environmental justice movement.

Although the role of popular struggles in public health improvement has received little attention from public health professionals, this may change, in part, because a primary justification for government and foundation-supported programs to promote partnerships between environmental justice activists and researchers is that these programs will lead to health-promoting environmental changes. NIEHS and other supporters of partnerships between researchers and community-based organizations encourage evaluation of policy impacts because evidence of efficacy is considered to be critical to future support and rational allocation of funding. These policy impacts are beginning to be assessed (Bullard and Johnson 2000; Minkler 2000).

During the 18th and 19th centuries, popular movements fought slavery, child labor, and occupational hazards. They fought for civil rights, education and suffrage for women and people of color, a living wage for workers, and access to medical care and other services. Similarly, the environmental justice movement is assembling scientific evidence in order to fight pollution, denial of basic amenities, lack of access to clinical care, and unsafe working conditions (Bullard and Johnson 2000; Shepard et al. 2002). Community-academic partnerships could create greater interest in the roles of popular struggles in public health, giving researchers insights about how community-based organizations affect living and working conditions, and giving community members access to research tools that help document impacts of their organizing on environmental conditions and health.

A Science of Environmental Justice

The concept of a science of environmental justice may seem contradictory or even oxymoronic to many scientists. What does science, an objective approach to obtaining knowledge about nature, have to do with justice, a moral and legal foundation for fairness in society? Study of causes of epidemiologic transition show that scientists use values and assumptions that shape the kinds of knowledge they create. The point of this example is not that medicine, public health, or popular movements made the greatest impact on declines of infectious and cardiovascular diseases in

the 19th and 20th centuries; rather, it is that scientific study of these phenomena has focused on what health professionals do and has virtually ignored what people most affected by health threats do for themselves. Science's commitment to objectivity, empiricism, replication, and other methodological principles does not change the fact that it is a product of society and therefore is always affected by the values and perspectives of that society, including values about justice (Wing 2003). In order to explain why a science of environmental justice could both advance and impede advocacy for public health, it is useful to consider some aspects of science and the environmental justice movement that are in conflict.

Science, despite some diversity, has strong norms that are maintained through the educational system, professional societies, and peer review. These norms contribute to science's capacity to produce useful knowledge, its enormous prestige, and its economic importance. First, science is primarily ahistorical. Generally, although scientists use specific materials, their interest is not in particular places, times, or people but in properties and relationships of abstracted parts of complex systems. This leads to a preference for studies of specific toxins over complex mixtures and of specific diseases rather than health or quality of life. Experiments and quasi-experimental observational studies attempt, as much as possible, to hold constant all explanatory factors except one, or at most a few, so that the independent effect of a factor on the outcome can be isolated. The power of experimental designs and multivariate analytic techniques of observational research derives from their success in removing historical contexts and complex relationships (Wing 1994).

Second, scientific culture maintains, for the most part, a strong commitment to a naive concept of objectivity based on insulating the scientist from historical context and social values that could pollute research. This endeavor is impossible, however, because social values are embedded in all language and concepts used by scientists to choose good research questions, design experiments, and collect and interpret data (Wing 2003). The process of removing social values from research, then, becomes one of removing only those values that are not normative in the scientific culture, values that appear alien, whereas those values that are built into the sciences are not recognized as values at all. It is normative to consider the

role of medicine versus public health measures in the decline of mortality, and unnoteworthy that the role of popular movements as a competing explanation has not been addressed. A more rational approach to achieving objectivity involves critical evaluation of the values embedded in science (Harding 1991).

Science has been developed and is dominated by well-educated white men (Harding 1991). The methods and knowledge produced by scientists have been extremely useful in addressing problems of governments and industries in areas such as agriculture, energy, communications, medicine, and the military. Women, people of color, and people without the means to obtain science education have had relatively little opportunity to become scientists. Historical and local ecological perspectives of scientists are affected by their membership in professional communities that are national and global. They are often geographically mobile, lack life-long attachment to local, multigenerational communities, and have little daily personal interaction with or commitment to local communities that include economically and racially diverse members. In addition to its widely respected positive features, science is marked by ahistoricism, naive objectivity, and lack of representation of women and people of color.

The environmental justice movement, despite its diversity, has some common characteristics that reflect its roots in traditional cultures and communities that have experienced environmental threats. First, the interest of the environmental justice movement is explicitly historical. It is engaged with problems, needs, and ambitions of specific people at specific places and times rather than with abstracted parts of a system. It is ecological in its perspective and places high value on detailed narratives and knowledge about sources of environmental contaminants, who benefits from their creation, and health, quality of life, self-determination, and cultural integrity. Such narratives may be preferred as evidence over measures of association between isolated parts of a system investigated using experimental designs. Trust, loyalty, social justice, respect for people, and environmental sustainability are valued more than an idealized concept of detached objectivity. The environmental justice movement has been led primarily by people of color, women, and people who live in communities that are adversely affected by environmental problems created by industry

and government, the very institutions that are closest to science. These characteristics conflict in several fundamental respects with the culture of science.

The scientific community is oriented toward assessing specific questions and producing knowledge that assumes problems have technological solutions. Evaluations of environmental concentrations of chemicals, their uptake in exposed people, and biological effects produce information that might be used to set an environmental standard and evaluate whether that standard is met. However, this knowledge may be of little value to exposed communities if the chemical is part of a complex mixture that is not assessed, if only one of several exposure pathways is considered, if impacts on quality of life are not recognized as an important issue, if effects on wildlife are ignored, or if contaminants are placed disproportionately in communities that lack political power. Technical solutions are fine, but for communities facing environmental injustice, their value depends on the extent to which social justice is advanced.

Prospects for a Science of Environmental Justice

Despite these different values, science and the environmental justice movement share important objectives that provide grounds for a science of environmental justice. Identification of hazardous agents and knowledge about how people become exposed can be of great value for self-protection, for pollution prevention, and for remediation, issues that are of great concern in communities facing environmental injustice. Studies of the location of pollution sources, unsafe environments, and the racial and economic characteristics of communities with environmental hazards provide an empirical basis for demonstrating patterns of environmental injustice. These studies may become a tool that low-income communities and people of color can use to organize locally, educate the general public, petition government agencies, and take legal action to protect themselves from unfair exposure (Bullard and Johnson 2000). Prevention of environmental injustice is also a key to environmental sustainability because wealthy communities' avoidance of the negative environmental and health consequences of industrial production, energy development, waste disposal, and transportation systems through transfer of hazards and disamenities to other communities

prevents a feedback between benefits and costs of production and consumption. A community that can send its waste to other places where people lack political power has little incentive to reduce the generation of waste.

Remaining faithful to the shared goals of the science and environmental justice communities can be difficult. Institutions that employ scientists may be closely tied to the institutions that reap short-term gain from unjust environmental practices, for example, the federal government, which chose low-income, rural communities, including American Indian lands, for development and testing of nuclear weapons. Furthermore, there is growing concern that public policies and legal decisions of the last few decades have created strong incentives for universities and other research institutions to commercialize research to the detriment of public interest science (Center for Science in the Public Interest 2003; Krinsky 2003). Universities hold patents on commercial products and provide corporate funding for facilities, research, teaching, and graduate students, and their faculty members are increasingly dependent on outside financial support to maintain their own salary support and fund their research. The Institute of Medicine notes that competition for extramural funding may have a negative impact on integrity in research (Committee on Assessing Integrity in Research Environments 2003). Integrity includes consideration of the social responsibility of science. In this climate, scientists are discouraged from pursuing research that requires intensive work with grassroots community organizations to develop trust and understanding of local problems, holds only modest prospects for extramural funding, and seeks to document environmental injustices or health and safety problems connected to industries that support universities, lobby government agencies, and contribute to the political campaigns of officials who could influence university funding (Krinsky 2003; Wing 2002)

Grassroots organizations may also face difficulties in remaining faithful to their principles and goals as they partner with researchers to build a science of environmental justice. Community-based organizations have difficulty maintaining financial support, especially compared with universities and other research institutions, including industry groups. They often lack technical staff with scientific, legal, and

fiscal experience, have fewer politically powerful friends and supporters, and their members have different race and class backgrounds than people in research institutions. Grassroots environmental justice organizations that become involved in science are in relationships with institutions that have vastly more economic and political power. Community–university partnerships that fund grassroots organizations can create pressures to divert efforts from direct action and addressing basic community needs, including political empowerment, to activities that are more beneficial to researchers and the organizations that fund them. Community leaders with modest incomes and life styles are invited to travel to far-away meetings, stay in nice hotels, and develop working relationships with professionals who accept their own privileged position and reject militancy about injustice. Although they develop knowledge and contacts, they spend time away from the communities that need their leadership. This can create division within communities because leaders obtain privileges that are not available to others and become adapted to relationships with institutions that, historically, have been viewed by the community with suspicion and distrust. Even grassroots organizations and researchers with strong commitments to a science of environmental justice face pressures to adopt colonial relationships in which scientists publish papers and obtain grants, and local leaders provide community access in exchange for prestige, perquisites, and funding. This situation creates a science of environmental justice that perpetuates the very forces that maintain injustice.

Prevention of colonial relationships between grassroots communities and privileged research institutions requires members of both groups to conduct careful analysis of relationships, motivations, and principles of justice as they pursue rigorous research, education of both scientists and community members, and a healthier environment. A focus on the long-term goals of the environmental justice movement, which are in many respects profoundly democratic and utopian, can be promoted by reinforcing connections to broader movements for popular democracy, peace, and social justice. These connections are threatened by attempts to improve the status and funding for environmental justice by separating it from the broader movement in order to avoid competition for funding.

Conclusions

A science of environmental justice is a science for the people, applied research that addresses issues of concern to communities experiencing environmental injustice, poor public health conditions, and lack of political power. Like research that is conducted in partnership with government regulatory agencies and for-profit industry, policy changes resulting from a science of environmental justice would not be instituted primarily by scientists, but by the organizations they serve, requiring serious attention to communication and education about science. Just as regulators use studies of dose response to set exposure standards, and drug companies use clinical trials to market new agents, organizations in the environmental justice movement use studies of environmental contamination, human exposure, and disease to educate affected populations and advocate for public health improvement. The potential for this relationship to affect public health is suggested by the history of epidemiologic transition in Europe and the United States, where evidence shows that declines in death rates for major diseases occurred as a function of improvements in diet, sanitation, housing, and workplace safety. The environmental justice movement is engaged with these same issues, especially as they affect population groups with the highest disease rates and the most to be gained from reduced exposures and increased access to public services and medical care.

Although partnerships for a science of environmental justice hold great promise, there are profound obstacles to development of any public interest science in an era of expanding science in the private interest (Krimsky 2003). Promotion of a science of environmental justice by visionary administrators in government agencies, universities, and foundations is important. However, these institutions can unwittingly foster colonial relationships with the populations that experience environmental injustice. Therefore, development of a democratic science of environmental justice ultimately depends on the strength of communities working for social justice and transformation of the institutions that create environmental injustices. Environmental health scientists can participate in strengthening community organizations by providing technical assistance, education, and financial support and by being ready to learn from them about the connections between science, environmental justice, and public health.

SUMMARY

The environmental justice movement represents community action to oppose racial and economic inequities in the burden of environmental health hazards. Bringing together traditions of labor, civil rights, economic justice, environmental, and antiwar organizations, the environmental justice movement mobilizes to improve living and working conditions and quality of life in communities that have high disease rates and poor access to medical care and health-promoting services. Historical evidence suggests these movements may play an important role in public health improvement via their effects on the environment. For example, most of the decline of mortality from infectious diseases between the mid-19th and mid-20th centuries occurred before introduction of effective medical interventions as a function of improved nutrition, sanitation, housing, working conditions, and reduced crowding. These factors are also important determinants of many noninfectious diseases. Environmental justice groups have formed partnerships with scientists in order to document environmental hazards, discriminatory patterns of exposure, and environmental diseases. These partnerships can provide empirical evidence that is useful for community organizing and grassroots efforts to promote policy change. Although scientists and communities facing environmental injustices share some interests, differences in their values and social privilege present barriers to the development of a progressive science of environmental justice. Programs to promote such partnerships are important, but they must avoid creation of colonial relationships and cooptation of movements for democratic social change if they are to effectively contribute to improved public health conditions.

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NOTES

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