## II. The Case for Ecological Medicine

**By Ted Schettler, MD MPH**

Medical advances have resulted in substantial decreases in morbidity and mortality in many parts of the world. Some of these advances come at considerable economic as well as environmental costs, and benefits are not equally distributed. Now medicine and public health struggle to address the changing patterns of disease resulting both from a rapidly changing and degraded earth and from the ways people live on it.In 1977, George Engel, professor of psychiatry and medicine at the University of Rochester, wrote a paper published in Science called **"The Need for a New Medical Model: A Challenge for Biomedicine."1** Engel contended that medicine was in a crisis that derived from adherence to an outdated model of disease. He developed an argument for a biopsychosocial model of illness and disease, arguing that exclusion of psychosocial factors distorted perspectives and even interfered with patient care. "The boundaries between health and disease, between well and sick, are far from clear and never will be clear, for they are diffused by cultural, social, and psychological considerations."

Engel's arguments were revolutionary at the time, but they have since entered the mainstream. No well-informed physician today can doubt that psychosocial factors impact a patient's health and response to care. It seems, however, that Engel's ideas need to be expanded. Engel encouraged us to consider how the psychosocial environment impacts human health and to incorporate those factors routinely into medical practice. It was a step toward getting us to think about other impacts of the environment on health--beyond social conditions to include the environment writ large.

**The Changing World** In 1998, **Jane Lubchenco**, outgoing president of the **American Association for the Advancement of Science**, urged scientists to rethink their social contract with the public.**2** "Part of our collective responsibility to society must include a scientific community-wide periodic reexamination of our goals and alteration of our course, if appropriate," she said. "Despite the plethora of reports examining the future of the scientific enterprise, I see the need for a different perspective on how the sciences can and should advance and also return benefit to society. This different perspective is firmly embedded in the knowledge of specific, identifiable changes occurring in the natural and social worlds around us."

Some of those changes are the following:

- Over 6 billion people inhabit the planet, and reasonable mid-level estimates predict 9-10 billion by mid-century. Two and a half more "earths" would be needed to support today's population if everyone were to use as many resources as Americans do.
- Stratospheric ozone depletion is the direct result of the release of ozone-depleting chemicals used for various industrial and agricultural purposes.

- Carbon dioxide concentration in the atmosphere has increased by nearly 30% in the last 150 years.
- Human activities are responsible for more atmospheric nitrogen fixation than all other sources combined. Nitrates contaminate ground water and surface water, and nitrous oxides the air, at toxic concentrations.
- Humans are responsible for more mercury deposition on the surface of the earth than from other geological sources. Freshwater and marine fish are sufficiently contaminated with mercury to require warnings to women of reproductive age to limit consumption because of risks to fetal brain development.
- Large numbers of plant and animal species have been driven to extinction, and most marine fisheries are severely depleted. More than half the world's coral reefs are threatened by human activities.
- Novel synthetic industrial chemicals contaminate the world's ecosystems, its human and non-human inhabitants, their breast milk and egg yolk, ovarian follicles, and amniotic fluid. The toxicity of most is little known.

**Changing Patterns of Illness** At the same time patterns of human disease are changing throughout the world. To remain focused on increases in life expectancy and decreasing child mortality in many parts of the world is to miss the "essential newness" of environmental change and associated diseases.**3,4**

- Newly emerging infectious diseases and new geographical distribution of older infectious diseases illustrate the capacity of microorganisms to evolve and adapt to changing circumstances. Antibiotic resistance, including multidrug-resistant tuberculosis, is increasingly common.
- Chronic diseases like hypertension, heart disease, diabetes, and asthma are increasing throughout much of the world.
- Depression and other mental health disorders are becoming new public health threats in many parts of the world with profound consequences for individuals, families, and communities.
- Nearly 12 million children in the US (17%) suffer from one or more developmental disabilities. Learning disabilities alone affect 5-10% of children in public schools, and these numbers are increasing. Attention deficit hyperactivity disorder conservatively affects 3-6% of all school children, and the numbers may be considerably higher. The incidence of autism is increasing.
- The age-adjusted incidence of melanoma, lung cancer in women, non-Hodgkins lymphoma, and cancers of the prostate, liver, testis, thyroid, kidney, breast, brain, esophagus, and bladder has increased over the past 25 years.
- In the US, the incidence of some birth defects, including hypospadias, cryptorchidism, some forms of congenital heart disease, and obstructive disorders of the urinary tract is increasing.

- Sperm density is declining in some parts of the US and elsewhere in the world.
- Asthma prevalence and severity are sharply increasing throughout the world, often in epidemic proportions.

Smoking, sun exposure, and diet explain few of these trends. Genetic factors explain, at most, about half of the population variance for a few of these conditions and far less for the majority of them. Improved understanding of development of the brain, immune, reproductive, respiratory, and cardiovascular systems and of gene-environmental interactions leads to the conclusion that other environmental factors contribute significantly to impairments. In laboratory animals, wildlife, and humans, considerable evidence documents a link between ambient levels of environmental contamination and malignancies, birth defects, reproductive success, and impaired behavior and immune system function.**Medicine's Failure** But there is more to the story. During the past 25 years, the medical-industrial complex has grown enormously in the US, and it now represents about 12% of the GNP. Its reach into many corners of our social and political institutions is extensive--patient care facilities and all the support services that these complex institutions require; medical device manufacturers; a large government, university, and corporate research enterprise; pharmaceutical sales; insurance companies; government regulatory agencies; public utilities; and so on.

Ironically, during this time of unprecedented global environmental change, the expanding medical industrial complex has itself contributed substantially to environmental damage through the manufacture, use, and disposal of an extensive array of materials, including toxic substances like mercury, cadmium, solvents, dioxin precursors, cleansing agents, and pharmaceuticals. Health care institutions use large amounts of water and are second only to manufacturing in electricity consumption on a square foot basis. The exhaust from vehicles traveling to and from medical facilities adds considerably to resource depletion and air pollution. Some of these environmental threats are unique to the health-care industry. Others are shared by other industrial sectors.

In sum, health care delivery services that are essential for addressing the "essentially new" ecological changes in the world also contribute to environmental degradation and resultant diseases.

Like other enterprises intended to focus on the public good in return for public support, medical and public health practices have attempted to respond to societal needs as they were perceived and articulated in the last century. But even by prevailing standards, the shortcomings of the dominant medical model have become apparent. Some alternative or complementary forms of individual medical care address these deficiencies in substantive ways. A less positive result has been a weakening of the public health system. The public health approach, which emphasizes primary prevention for individuals, families, and communities, has often stood in contrast to and competed unsuccessfully for resources supporting the biomedical model of treating disease. And environmental health is often narrowly imagined as

dealing with little more than the impacts of air, water, or food contamination on the wellbeing of people.

**The New Context** The context for any of these approaches or practices has fundamentally shifted, and a new perspective is needed to guide how medicine advances and returns benefit to society. This perspective must be embedded in knowledge of changes in the natural and social worlds, and the shifting patterns of disease. Indeed, not only must health care providers and institutions reexamine their stance in the world, but all individuals and communities would do well to become aware of how their wellbeing is connected to other people, other species, and the natural world.

The challenge is to integrate an ecological perspective into health care and public health practice in ways that demonstrate understanding of the identifiable changes occurring in the natural and social worlds around us, as we collectively develop the new social contract for medicine.

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