Mr Fingfeld

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To Members of the Health and Safety Committee:

Ken Nelson and I thought you would be interested in Frank Princi's excellent discussion of the present air pollution and health situation.

Very truly yours,

Don G. Fowler

Don G. Fowler
Secretary

DGF:md
enc.

Look Ahead with Lead

Medical Perspective in Atmospheric Hygiene

Frank Priest, M.D., Cincinnati

MAN'S PRESENT CONCERN with the effects of the environment on health is neither new nor unusual. Every physician is familiar with the fact that it has been customary and traditional for patients to blame their complaints and physical ills on the chemical and physical stimuli to which they have been or may believe they have been exposed. The rapidly increasing industrialization of our society has produced new materials and exposures, and has accentuated old fears.

The average practitioner who has been trained to recognize and treat disease relies heavily upon the patient's account of the development of symptoms for his ultimate diagnosis. When frank disease occurs and physiological dysfunction is perceivable, definitive diagnosis and treatment become possible. Through training and experience, the physician is competent to recognize disease states and to interpret the significance of improperly functioning physiological systems. During no period of his training, however, and certainly not in medical school, is he likely to have had any exposure to concepts of what constitutes good health. Yet, in the twentieth century, when the incidence of infectious disease has been reduced dramatically, thoughtful practitioners are noting an increase in the number of healthy patients who are worried about their health. This is an odd phenomenon at a time when the age-adjusted mortality rate in the United States is almost two-thirds less than it was at the beginning of the twentieth century.

The concern for health and the anxiety that the discharge of wastes into the atmosphere will produce illness and suffering and will shorten life are natural results of our basic tenet that cleanliness and health are synonymous. This concept was traditional even prior to the time that there was any knowledge of the effects of bacterial agents. It is entirely natural that individuals will become both distressed and concerned for their well-being and safety when atmospheric pollutants produce reduced visibility, soiling of buildings and clothing, and even physical discomfort such as eye irritation or coughing. The mere fact that any material in the environment is classed as a common nuisance or is capable of becoming a safety hazard should justify its reduction or elimination without implying the development of chronic crippling disease or effects on future generations, unless such consequences can be foreseen reasonably and not implied dramatically and almost hysterically.

Such phrases as "aerial garbage," "atmospheric filth," and "air pollution linked to the common cold" may have great dramatic appeal in the daily newspapers, but they have no place in medical periodicals where, unfortunately, they all too often appear. Such statements only annoy the earnest research scientist and confuse the private practitioner whose immediate problem is the understanding and management of the individual patient and his symptoms.

For these reasons, it is imperative that the medical profession devote its attention to a calm appraisal of the correct facts of health, disease, and the environment. It is true that there is a great deficiency in the information concerning the effects of various atmospheric pollutants, but it is equally true that a great body of information concerning the cause of disease and the effects of chemicals on biological systems is available. The implication that no background of information exists and that all biologic phenomena produced by the absorption of various substances must be developed as a new science is both misleading and erroneous. It is alarming to see vast sums of money being expended to rediscover the obvious or to obtain certain fundamental information that is already available and could be well evaluated by a few hours of discriminating study in a medical library.

Articles in popular magazines and newspapers perhaps need dramatic and exaggerated statements

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critically, so that other investigators will be able to carry out similar observations to confirm or deny the conclusions. Investigators may arrive at reasonable opinions by calmly appraising all data. This has always been the scientific method.

Recently, however, there has been a plethora of articles in the medical literature concerning the effects of air pollution. Rarely is any portion of this problem discussed without mention of Donora, the Meuse Valley, Poza Rica, and the London smog. Although no direct statements are made to relate these incidents to the general air pollution problems of our large cities, the implication is specific that the problems are similar. The scientist has always been expected to be unfeeling, disinterested, and a careful observer of physical or biological phenomena. If this image is not completely attainable because the scientist is also a responsible member of society, he should, at least, be nonpolitical and nonhysterical. Scientific research has always been a slow, methodical, and conscientious process. No amount of governmental financing or legislative wisdom will ever resolve the problems of physiological reactions, the solutions of which have eluded dedicated scientific observers for centuries.

It has been stated that democracy is the best soil for science. This is indeed correct, provided that neither science nor democracy becomes manipulated. The data obtained and interpreted by official groups are no more valid than the universal acceptance of their interpretation by other competent investigators. Let us not forget this medical lesson that was taught in 1915. At a time when there was adequate evidence to show that pellagra was a deficiency disease, the report of the Thompson-McFadden Commission was published in New York stating that the disease was transmitted by the stable fly. This report was based on "an extensive epidemiologic study," and delayed treatment and prevention of the disease.

Practicing physicians who are intimately and directly concerned with the health and welfare of their patients must depend upon specialists in research to describe and define for them new knowledge concerning health and disease. They will fail to understand how research workers can disagree completely about matters of cause and effect in problems of atmospheric hygiene and will, of necessity, conclude that what is being discussed is neither science nor medicine and that their own opinions, even though based on prejudice, are

The first of these guidelines has been stated best by Comar,[1] who has written: "A reputable scientist speaking in his own field, deserves careful attention—a scientist speaking out of his field should be given one vote, just as anyone else." There are indeed many reputable specialists concerned with the effects of atmospheric contaminants on the biological system. Those who have specialized in industrial hygiene and occupational diseases have attained a high degree of maturity and professional skill in the past quarter century. Their ability and experience should be utilized and appreciated to the fullest extent. The average physician does not realize that these specialists exist, and even official agencies are inclined to overlook their significant contribution to environmental health.

Our increased understanding of the effects of environmental factors on health is a direct development of our highly industrialized society. Continuous studies of the industrial environment and its workers have produced medical and engineering principles based upon physiological and biochemical concepts of disease that have proved their value over many years of observation. These principles are based fundamentally on the concept that before one can begin to understand the influence of chemical and physical stimuli on health, one must have a working definition of the healthy state. The current favorite in definitions of health appears to be that developed by the World Health Organization (WHO): "Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity." This definition has come to be synonymous with comfort, happiness, and material prosperity, and perhaps has certain social justification. But as a basic requirement for assisting in the quest for information concerning the effects of the environment on individuals or populations, it is confusing and almost irrelevant. Basically, it produces no point of departure for understanding whether or not an environmental stimulus has produced illness, disability, or reduction in *life span*—and this is the physician's problem.

Medically, health is fundamentally a biological—and, therefore, a physiological—problem. There is no doubt that social, psychological, and even political factors will influence physiological reactivity. In a medical appraisal of cause and effect, however, these cannot and must not be confused with chemistry and physics. Therefore, future advance-

ment in the knowledge of atmospheric hygiene must be based on usable concepts of health in terms of physiological reactivity, and not on Utopian concepts of social welfare.

Physiologically, man is a reactive organism. Any stimulus will produce a physiological reaction. This reaction may be compensatory or adaptive, it may be inadequate and fail to offer adequate protection to normal tissue functioning, or it may be overprotective, and this very overreactivity may in and of itself produce tissue damage and physiologic abnormality. These 3 possibilities are the result of any type of environmental intrusion on the organism, whether it be chemical, physical, or bacterial. Concepts of the health state must, therefore, take into consideration Cannon's[1] concept of homeostasis and Dubos'[2] concept of adaptability, in addition to the effects produced by our changes in social attitudes, living and working habits, drugs, food, and industrial environment, all of which influence, in one way or another, both disease patterns and personal attitudes.

Any one of these changes is difficult to assess, both in terms of its degree of importance and its influence on the population. Collectively, their impact cannot be determined by conjecture and crash research programs. In fact, it is entirely possible that the only reasonable definition of health would be one that would vary from individual to individual or from group to group. Since health attitudes are so personal in nature, it is unlikely that any definition will ever be acceptable to all. Nonetheless, Socrates' definition, "Health exists when the organism is in harmony with its environment," satisfies physiological criteria and establishes a point of departure from which one can determine when a disease state exists. Since harmony denotes a state of equilibrium, this definition may be reworded to read a state of "dynamic physiological equilibrium." Regardless of the lack of specificity of this definition, it is useful in the understanding of normal physiological processes and in an understanding of those degrees of abnormality known as disease. It also defines the fact that there is a variability in the health state and that health is not a static phenomenon.

Continuous and intensive research is required in the study of atmospheric pollutants and their relationship to health and disease. The confirmation of a point of view or a speculation is neither research nor in the interest of the public. Advances in medical understanding depend, ultimately, on general advances in physiology and biochemistry, and in the development of new knowledge concerning the metabolism of a variety of substances, both intrinsic and extrinsic, in the body. This research is laborious, time-consuming, and necessarily repetitive.

The current medical literature on air pollution has become overwhelming and persuasive. By implication, the practicing physician is advised that crippling and death-dealing disease is being produced, on all sides, by both known and unknown chemicals in the atmosphere. These articles all seem to share certain common characteristics: they are written as reviews of existing diseases (many of them nonspecific and of obscure etiology), they are vigorous and even passionate in nature, they relate cause and effect statistically (or epidemiologically, depending upon the author), and they are written by persons whose interest seems to be relatively new. Statements from one[3] of these most recent articles are typical: "One of the most important problems in medicine today is the low-level but chronic poisoning of our atmosphere by dozens of chemical processes characteristic of an advancing civilization, a poisoning which has its effect over the course of many years, but which nonetheless inexorably cripples and kills. . . . Although a connection between air pollution and nonmalignant respiratory diseases can only be proposed tentatively, the connection between air pollution and cancer of the respiratory system is as sure as statistical studies can make it."

This may be interesting reading, but it is directly opposed to the opinion of one of the best known and most outstanding health engineers of the present century. Dr. Abel Wolman has stated:[4] "The intuitive assumptions that a polluted atmosphere is not conducive to the best health still lack either strong statistical or epidemiological support. The use of suggestion, as a mask for scientific ignorance, and of implication, as a substitute for epidemiologic evidence, are great temptations for bolstering budget, for focusing public attention, and providing action even if ill-defined. To the scientist, this route is highly suspect. To the politician it is a rich method of raising popular interest and hence 'getting something done.' To the columnist, on the prowl for the dramatic and plausible, if not the accurate, the route is fruitful."

Another highly respected engineer[5] who has devoted his life to the study of the environment and its relationship to health has quoted one of his contemporaries as follows: "I have discussed these problems many times with Dr. Morris W. Goldblatt of Britain, a toxicologist of world-wide reputation and an authority on carcinogenicity. By first hand investigations he knows a lot about air pollution troubles. He told me that he believed there is no evidence that chronic disease of the eye, or in the chest or elsewhere has been engendered by Los Angeles smog. He even went further and said that there is no evidence that photochemical smog (as in Los Angeles) has been responsible for the incidence of lung cancer in California." Dr. Drinker[6] concludes: "There is no convincing evidence that air pollution is presently endangering the public health in the United States."

It may be argued, historically, that Semmelweiss and Pasteur were right when the experts were wrong. But neither the problems nor the situations are analogous. In fact, almost the reverse is true. In a recent issue of THE JOURNAL, the problem has been brought well into focus by a somewhat amusing, but extremely accurate, editorial[1] concerning fallout: "When the news media and the bureaucratic bubbleheads state that you *may* develop abnormalities in the fifth generation or the sixth or even the seventh, this is true. It *may* also occur in the *eighth* generation, but even the Bible goes only unto the seventh. You can't argue with this kind of logic. You *may* fall off a truck tomorrow and kill yourself, but you may not. You *may* die of heart disease while you are reading this editorial, but you may not. Also, you *may* get cancer from drinking cranberry juice. This kind of political sloganry—'you *may* develop . . . .' 'you *may* be affected by . . . .' 'you *may* become . . .' resembles the advertising sloganry: 'If you have leprosy and need salicylic acid, take aspirin.' This is the worst kind of deception because it tells the truth.

No better example of this type of deception exists in the current literature than statements[2] based on Pavlovian concepts that imply that any measurable physiological reaction is deleterious. The fact is that these investigations demonstrate merely that a stimulus will provoke a reaction. This is indeed a physiological fact and is not necessarily evidence of injury.

Aside from these basic physiologic considerations, it is important to consider, also, what we really know about the materials in the atmosphere. The term "air pollution" may be descriptive, but it has no etiologic significance. Without adequate definition of the airborne materials that are thought to produce disease, and without adequate definition of the disease that is produced, it is fatuous to attempt either to diagnose or prevent disease—the primary purpose of all health workers.

An outstanding example of this situation is the present confusion concerning chronic bronchitis. The disease is not only poorly defined, there is also confusion concerning its cause. For years, tobacco smoking, sinusitis, postnasal drip, alcoholism, infection, organic and inorganic irritants, and so forth have been regarded as causative agents in its production. It is said to be characterized by changes in the epithelial mucosa of the tracheobronchial tree, and by the expectoration of increasing amounts of sputum of variable consistency. Yet, even this common definition is interpreted differently by different observers.

Regardless of the differences of opinion concerning the diagnosis or severity of bronchitis, the application of known scientific principles to the study of this disease will clarify the problem and result in improvement. The implication, however, that all dusts, fumes, and gases produce bronchitis will further confuse, frighten, and fail to reduce the incidence of the disorder. It may, in fact, while attempting to reduce one evil, real or imagined, result in more serious health problems. "Without adequate means of comparing behavioral and physical disorders quantitatively, it is impossible to say, in the sum total of human ailments, which causes the more actual incapacity, psychic or organic influences." While considering the effects of atmospheric contaminants on health, it might be well to consider the effects of air pollution propaganda on health.

To suggest merely that the incidence of a disease or disease condition is related mathematically to the increase in soot-fall or lower visibility is not helpful to either patients or physicians. The substance in the air that is under suspicion must be examined critically from the point of view of both chemical and physical characteristics. When the component has been identified and classified, its effects must then be measured both in the atmosphere and in the laboratory. If the findings in one do not confirm those in the other, one should pause and reflect on other influencing factors. There are times when laboratory results are not confirmed in environmental exposures, and vice versa. A remarkable example of this type of occurrence is that acrolein and formaldehyde do not account for all eye irritations in smog, although they appear to do so in simple laboratory systems.[3]

At the opposite pole of unidentified causative agent and undefined disease entity are those atmospheric hazards where the agent is known and understood precisely, and its effect has been studied for many years. Lead is such a case. There is a general impression that little is known about the absorption of lead and its physiological consequences in the organism. Perhaps no other environmental substance has received more detailed investigation and study. The signs and symptoms of intoxication by this material have undergone long study and observation, and are reported accurately in most textbooks of industrial hygiene, toxicology, or occupational diseases. Despite this fact, medical journals continue to publish articles stating that leaded gasoline is responsible for headache, dry nose, colitis, kidney disturbances, rheumatic signs, tremor, itching of the skin, eczema, temporary visual impairment, backache, vegetative dystonia, and inflammation of the nose with abscess formation.[4] With this appalling array of symptoms and diseases to consider, is it any wonder that there is concern about the levels of lead in urban atmospheres when the amount of vehicular traffic continues to increase?

Yet, detailed studies[5] of at least one urban area (Cincinnati) over a period of 10 years have shown that the trend of concentration of lead in the at-

mosphere has been steadily downward, despite the increase in motor vehicles and gasoline consumption. It is obvious, therefore, that one cannot imply that there are greater levels of lead in the air merely because of increased use of the compound, since other unmeasured factors may tend to reduce what might be considered reasons for increases in concentration. In estimating the degree of any environmental hazard, direct measurement of the environment is essential.

In industry, the allowable concentration of lead in the atmosphere that is considered safe for workers is 500 micrograms per cubic meter. It might be postulated that since the working week represents almost 30% of the total week, a safe concentration in the ambient atmosphere would be 60 micrograms per cubic meter. This might be true if the body were simply a nonreactive receptacle, and cause and effect were a straightline function. But, since this is not true, and since rates of absorption, metabolism, and excretion are important, such a figure might be either too high or too low. In fact, the subject of lead metabolism has been discussed extensively,[5-8] and the evidence is clear that the amounts of lead in the atmosphere (taking into consideration concentration, particle size, absorption, and metabolism) are not hazardous. Perhaps it is significant that lead in the atmosphere of Los Angeles has been reported at levels as high as 42 micrograms per cubic meter without evidence of increased lead absorption or illness.

Perhaps the most rational attitude toward the problems of atmospheric hygiene was best expressed by Prindle,[9] in 1961: "At present we do not have enough facts to make completely rational decisions in the area of health and air pollution—not enough facts to know when to act, what precisely to take action against, and to what definite purpose. Until we do, we can recommend only that the public take heed of the nineteenth century's progress in cleaning up filth through pragmatic experience." These are wise words, indeed, and when cleanliness or comfort are the factors that are being affected, let us by all means get rid of the offending agents, but let us not imply that there is a threat to life where there is only an offense to our comfort and pleasure.

In addition, it would be well to discuss the true facts when reporting economic loss from air pollution. When it is reported that the health effects of air pollution have resulted in billions of dollars in health and economic costs, let us be prepared to show the data that demonstrate these conclusions, or be prepared for satire[10] that demonstrate that only a few of the catastrophic conclusions will add up to one-third of the gross national product. Equally important is the fact that in legislating certain materials out of existence, we run the risk of producing even greater measurable loss. Finally, the ability to control the environment must be weighed carefully against the fruits of such control. Though the general problem is of great importance, there is no sudden emergency, and the problems that do exist can await clear thinking and thoughtful investigation. It is truly anomalous that, although it has been noted[4] that dental caries, one almost universal disease related to environmental factors, is susceptible to the manipulation of the environment by adding fluoride to water, a large body of public opinion is opposed to this prophylactic measure.

About one year ago the steps essential to decisive statesmanship in the field of atmospheric hygiene were listed as follows:[11] (a) A precise statement of the essential characteristics of the environmental problem; (b) An appr.. al by competent professional groups of the real and apparent health aspects of the various factors involved; (c) The development of suitable standardized methods for the analysis of exotic chemicals, (d) The design and promulgation of criteria of health, safety, and comfort in the environment; and (e) The toxicological effects of the substances finding their way into the environment must be assessed on a continuing basis by professional groups, preferably rooted in voluntary health agencies rather than government.

The practicing physician must be concerned with the immediate complaints of his patient. He knows that some persons have greater degrees of reactivity than others, not only to the environment, but to food, beverages, and so forth. In the present period of confusion and disagreement, he must realize that there are specific criteria for the diagnosis of the effects of known substances. He will search these out in the proper medical tradition, and he cannot afford to assume that some hitherto unknown disease entity has been produced by exposure to and absorption of some unknown compound or combination of compounds. When he does suspect the influence of environmental etiologic factors, he will consult with his colleagues who are recognized specialists in the appraisal of the environment and in the study of environmentally-produced diseases.

Above all else, the history of biology and medicine point out the necessity for bearing clearly in mind our own ignorance of the optimum. Although it has been possible to control many factors in the environment, and it may be assumed that it will be possible to modify many others, Dubos[12] has observed that: "There are other factors that cannot be controlled so readily, and perhaps not at all; namely, (1) Those that are built into the hereditary fabric of man, his biological cycles and perhaps his fundamental emotional responses. (2) Certain unpredictable natural forces and, more important perhaps, the unpredictable effects of technological civilization."

These are the facts of life as we have always known them. This is not a philosophy of despair, but, rather, an awareness of our own limitations of

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SUBSTITUTION OF CHRISTIAN SCIENCE TREATMENTS FOR MEDICINE AND SURGERY.—This rule that Christian Science treatments cannot be substituted for medical and surgical care in workmen's compensation cases has been upheld by all the authorities on workmen's compensation law who are in accord with the law that workmen's compensation benefits will not be paid for the disability or death of an "employee" under the several workmen's compensation acts, when either is caused, continued or aggravated by an unreasonable refusal to submit to prompt and necessary medical and surgical treatment. Likewise, this strict rule also applies to occupational disease claims that are brought by Christian Scientists under the several occupational disease statutes.

In personal injury claims which are brought by Christian Scientists, the law has been clearly and concisely expressed as follows: "It is a rule of general application that one who has been injured by the negligence of another must use reasonable care to promote recovery and prevent any aggravation or increase of the injuries." Under this rule the injured person is under a duty to secure promptly the necessary medical and surgical treatment, if the nature of the injury is such as reasonably to require it, so as to prevent or reduce the aggravation of the physical injury and mental suffering. If the injured person is negligent and allows an unreasonable length of time to elapse between the date of the injury and the time the necessary medical and surgical care is resorted to, then such negligence is regarded as an intervening cause that may either bar in whole or substantially reduce the amount of damages that can be recovered from the party at fault. Thus under the law in personal injury cases, Christian Scientists can recover little or no damages when the evidence shows that because of their belief they have refused to obtain necessary medical and surgical care for their injury, and instead have relied solely upon Christian Science treatment.—Rubenstein, I. H.: Claim Cases by Christian Scientists, *Industr Med Surg*, September, 1962.