Environmental Health

Edited by
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Foreword

For the thirty-five years that I have been engaged in environmental health activities I have been aware of the need for a text that covers the subject comprehensively. Dr. Purdom, who served for many years as an environmental health engineer, administrator, and educator, apparently has also been conscious of this need. In this volume he has gathered an outstanding group of experts in specialized areas, each of whom has provided a chapter in his area of greatest competence. Dr. Purdom provided the chapter outlines and, by his diligent review of the material that was submitted, assured adequate consideration of all health aspects and the creation of a definitive, harmonious work. In addition, he has provided an excellent introductory chapter dealing with man's health and his environment and a very useful concluding chapter on planning and administration of environmental control programs.

In my opinion, this work provides more extensive coverage of its chosen spectrum than any other. It will serve as a text for the generalist and as a substantial base for those who desire to pursue further specialization in any particular area. In these times, marked by emotion and hysteria, the book should also provide the factual information necessary for rational discussion of possible solutions to many of our environmental problems.

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Preface

This text is concerned with the interaction of man and his environment as it affects his physical and mental health and social well-being. Thus, environmental conditions that foster the transmission of communicable diseases and exposure to toxic chemicals and hazardous physical conditions are reviewed. Conditions that stimulate efficient functioning, mental development, and cultural satisfaction are also included.

The book was developed primarily to fill a need for a text that would provide a comprehensive overview of man–environment–health interrelationships as well as a basic background for those working in any environmental health discipline. It is assumed that the reader has some familiarity with basic science. The book may be used as a text for first level graduate courses and advanced undergraduate courses. It will also be useful as a single text to anyone working in the environmental health sciences.

An introduction to the field of environmental health is followed by chapters devoted to areas of special concern. The book is concluded by a chapter on planning environmental health control programs. One will find discussions of environmental health hazards, nature of the problems involved, and means of their control. References guide the reader to more detailed information in these areas.

Some of the chapters have been organized in a manner not usually encountered. Thus, food is treated as a total system. Preservation is covered in detail as is material on safe handling. Food quality to meet human needs is discussed as are food poisoning and food-borne illnesses.

The chapter on accident control illustrates the importance of considering man, machine, and environment a total interacting system. Material on specific influences of environmental factors on man is found in the chapter on accident control, while the chapter on occupational health is concerned more with the principles and approaches

to industrial hygiene. The engineering of ventilation and dust removal, heat and humidity control, and noise and vibration are covered in the chapter on environmental control.

This volume avoids the inclusion of some detailed information that is readily available from other sources such as the various "Standard Methods" for analysis of water, food, etc., as published by the A.P.H.A. with others, the "Standard Ordinances" as published by the U.S. Public Health Service, and various standards published by the National Sanitation Foundation.

There is a mounting interest in the environment of man and in ecology generally. While this is not a text on ecology, it should be of value to ecologists in assessing the peculiar needs of modern man and the current environmental hazards to man. As will be seen, most of the hazards discussed are the result of man's activities or his modification of the environment. The perspective is not one of doom. Rather, if one considers the elements in this text and makes public policy decisions with these factors in mind the end result will be an environment that is stimulating to the physical, mental, and social well-being of man.

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P. WALTON PURDOM

I. INTRODUCTION

Will Durant, in "The Story of Civilization" (1954), notes that the words "city" and "civilization" have a common origin. Durant believes that the cross-fertilization of minds at the crossroads of trade sharpened and stimulated intelligence to creative power and, although civilization was sown in the peasant's hut, it blossomed only in the towns.

In the cities, man has demonstrated his distinction from other animals in the complexity of his social order, in his scientific and artistic pursuits. It is in cities, particularly, that man has demonstrated his capacity to modify his environment to suit his ends and whims.

While great achievements have emerged with the advance of civilization (city culture), ignorance, indifference, mismanagement, and preeminence of economic values have frequently joined to give cities the image of poverty, pollution, and pestilence. Thus many sympathize with Bronowski's (1962) observation: "I am not the first prophet, or the first dreamer, to hope that the monstrous cities of today, like glaciers of an industrial ice age, will begin to melt away." Realizing that this is not realistic, he continues to state that " . . . there is no special virtue in agriculture, and no special evil in industry. What is wrong is a by-product of the way we organize our industries in large towns—the tedium of traveling two hours a day, the exhaustion of crowded canteens, the division between factory or office work at one end of the journey and dormitory leisure at the other, the lack of community." We have the capacity, however, to produce an environment that is healthful, stimulating, and enjoyable. Perhaps through education such a dream will become a reality.

In the remainder of this chapter, the nature of man-environment relationships, as they affect man's health, will be examined. In subsequent chapters, more detailed consideration will be given to special aspects of the environment, with a concluding chapter on a comprehensive approach to environmental planning.

II. DEFINITION OF ENVIRONMENTAL HEALTH

Environmental health is that aspect of public health that is concerned with those forms of life, substances, forces, and conditions in the surroundings of man that may exert an influence on man's health and well-being. This definition includes other people as part of man's surroundings that contribute to the status of environmental health. This interacting system may be depicted as follows:

$$\text{MAN} \rightleftharpoons \text{ENVIRONMENT}$$

where not only do man and his environment interact, but man is shown to be a vital factor of his own environment.

Early definitions of public health (ca. 1920) reflected concern with communicable disease and stressed prevention of disease. While prevention of undesirable conditions and consequences is fundamental to most definitions, public health, or just plain health, today has a much broader connotation including the attainment of desirable positive health values, in addition to the prevention of undesired negative ones. Consequently, the definition of public health developed by the World

Health Organization, and widely accepted, states, "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (Hanlon, 1969).

In recent years, environmental engineering is a term that has come into wide use, e.g., the American Academy of Environmental Engineers (formerly The American Academy of Sanitary Engineers). While the meaning of this terminology is somewhat controversial in some circles, it generally refers to the study of man-environment interrelationships and the modification of the environment for man's benefit. To the extent that there is concern for man's environment as it relates to his health and well-being, including freedom from illness, health maintenance, human efficiency, comfort and the enjoyment of life, it is environmental health. Other aspects of environmental engineering and science are concerned with animal and plant life, use of property, and management of resources. At times, it becomes impossible and useless, because of direct and indirect interrelationships, to make any distinction between those activities concerned with man's health and other aspects of environmental engineering and science, as in air and water pollution. Both natural and social sciences have application in the development of a suitable environment for man.

III. HISTORICAL PERSPECTIVE

"Sanitation is a way of life" according to the National Sanitation Foundation. Frequently, throughout history, the status of the environment, which historically has been equated with sanitation but is now much broader in concept, has been the measure of civilization. In fact, the aggregation of population has always seemed to create environmental health problems which had to be solved before the populace could survive and enlarge.

The earliest public health measures were concerned with environmental matters. Many customs, taboos, and religious practices had their roots in observed or presumed interaction between man and environmental conditions. Moses' Laws have dictates concerning sanitation which could have applications today.

The supply of water and the removal of wastes have been critical problems for aggregations of people. Drainage systems were built by the Minoans (3000-1500 B.C.), and the Egyptians (1000 B.C.) were noted for irrigation and other public health measures (Hanlon, 1969). The Grecians were concerned about personal hygiene and cleanliness.

The Romans built aqueducts and drainage systems which were marvels. Archeological excavations in India and the Middle East show that

other ancient civilizations had similar systems, although not as impressive as those in Rome.

In the Middle Ages, there began a change in social organization which initiated the rise of many cities. With the growth of these cities, diseases were more easily communicated from one person to another. Terrible pandemics swept through the cities of Europe, decimating the population. Such diseases as cholera, associated with polluted water, and bubonic plague (the "black death"), associated with rats, were rampant. The very existence of the cities was threatened.

With the Renaissance and the development of the microscope, it became possible to identify the bacteria that caused communicable diseases. The first depiction of bacteria was by Anthony van Leeuwenhoek in 1683. Through the work of Pasteur, Koch, and others knowledge of the role of bacteria as a cause of disease was developed and enlarged (De Kruif, 1926). Interestingly, the earliest applications of Pasteur's work had commercial value in fermentation and animal diseases. (In modern times, the American public was seemingly unconcerned about trichinosis being spread by the feeding of uncooked garbage to swine, but when a disease of hogs, vesicular exanthema, was found to be transmitted thereby, laws prohibiting the practice were passed with great speed.)

Before science established the cause of disease, man had, at times, instinctively avoided circumstances suspected of causing disease. Thus an epidemic of cholera and typhoid in London in 1854 was terminated by the simple expedient of removing the handle to a pump on a well located adjacent to a sewer (Prindle, 1967). The term "malaria" was the name applied to a disease thought to be associated with "bad air," which was equated to the night air. We now know, of course, that the female anopheles mosquito attacks man in the evening and transmits the causative organism. Unfortunately, many of today's environmental hazards have been introduced so rapidly that man's instinctive reactions have not had time to adapt so he is not aware of their dangers (Dubos, 1969). Nevertheless, such designations as "New Orleans" or "Yokohama" asthma, may well be the same intuitive labeling, witness "miner's consumption" later found to be silicosis.

With the coming of the Industrial Revolution new hazards to man were introduced into his environment—physical injury from machines and work methods, toxic exposures, and other stresses. It was about this time that the first organization of public resources and society in the interest of public health began. Developments in England and the United States were somewhat parallel. Although they did not result in immediate achievements, in both cases social organization for public health can be traced to two reports. In England, it was the "Report on an Inquiry into the Sanitary Conditions of the Labouring Population of