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# Environmental and Occupational Medicine

Second Edition

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William N. Rom

# *Environmental and Occupational Medicine*

**SECOND EDITION**

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# Foreword

The considerable changes in the perspectives of public health and preventive medicine have had many scientific, academic, administrative, social, political, and economic consequences. The long held—and productive—focus on infectious, communicable illnesses has been replaced by a new appreciation of and concern with xenobiotics, noninfectious agents that have the potential to cause significant human disease. The speed with which this shift has come about mirrors equally extraordinary changes in the society in which we live—in industry, technology, transportation, population growth, food, and interdependence. One may be tempted to ascribe a good part of this reorientation to successes in controlling infectious diseases. During the hundred years since the discovery of the tubercle bacillus [1,2] the death rates from pneumonia, tuberculosis, typhoid fever, typhus, and poliomyelitis have plummeted, especially in developed countries, as the result of clean water, sewage systems, pasteurization, better nutrition, improved housing, and even vaccination and antibacterial drugs.

However complex the roots of this rapid change may be, its dimensions and depth are clear. Congress debates the Clean Air Act and the Environmental Protection Agency's approach to the effect of gasoline additives on low-level lead exposure, and the Superfund is set up concerned with waste dumps. Toxicology has replaced bacteriology as a major underpinning of current public health research.

As I look at this it appears that four interdigitating, interwoven threads formed our present fabric of understanding. The first component was geographic pa-

thology, which demonstrated considerable variations in disease patterns in different lands, among different groups of people, at different times. (Two explanations were possible: that the peoples affected differed genetically among themselves or that their environments differed. The statistical data demonstrating differing experience provided few hints to what the environmental differences might be, and they are still not entirely clear, but the need for an explanation was challenging.) The second component was the examination of cigarette smoking, started in the 1940s, in which over the next 30 years it was demonstrated that major human diseases—cancer of the lung, bladder, larynx, and pancreas; coronary disease and stroke; chronic obstructive lung disease—were exogenously derived, mostly from agents in our personal environments. The third component was the body of painfully gathered data on occupational toxicants that produced a variety of biologic effects—neoplastic, neurologic, immune, hepatic, renal, and metabolic. The last component was the observation that control of exposure not only could reduce the incidence of disease but in some cases might even lead to reversal of risk. Dose–disease response was given an additional dimension.

When did this change occur? As with much in human experience, no single sharp demarcation line can be set; but as changes in human thinking go, this one has a fairly well-defined mark. It is curious how close agreement can be, even as we examine our experience from different points of view. Commemorating Oettlé's contributions to geographic pathology, Richard Doll believes the change occurred in the

early 1960s [3]. A landmark in our understanding of tobacco's effects was the first Surgeon General's Report in 1964 [4]. The asbestos industry insists that it did not appreciate the wide potential of asbestos disease until the same year [5]. The first demonstration of reversal of risk in human disease occurred soon after [6,7]. Plans to give administrative and institutional form to this growing understanding began about the same time, culminating in the establishment of the National Institute for Occupational Safety and Health in 1971.

Simultaneous with discoveries that contributed to our understanding, and concomitant concerns regarding the effect of exogenous agents in our personal, occupational, and general environments, there came, *pari passu*, the development of methods to seek such knowledge, ranging from environmental epidemiology to biochemical toxicology. Using these established approaches, it is likely that in the future we shall be able to define and evaluate additional agents that are responsible for significant disease, particularly such chronic illnesses as neurologic degeneration, cancer, renal dysfunction, and birth defects.

But there are additional prospects as well, and one can begin to see the outline of fruitful new opportunities. In considerable part, these are derived from our observations of the latent period associated with many human diseases [8]. "Latent period" is perhaps an inadequate phrase, as it suggests that once exposure to a toxic agent sufficient to cause disease has occurred, any resulting change lies dormant, to suddenly spring to life again decades later. This is unlikely to be so. Rather, smoldering changes are under way. With cancer, these are believed to correspond to multistage carcinogenesis, roughly described as initiation, promotion, and progression.

This understanding holds much promise. It will require reappraisal of such terms as "epidemic," sacrosanct since the days of Hippocrates, and the addition of "slow epidemic," with a time frame of years or decades instead of days or weeks, to include both infectious and noninfectious agents. It will open a new panorama of research opportunities, using the remarkable new array of molecular biology techniques to explore what is happening in cells and tissues in the months, years, and decades after exposure. Weinstein has dubbed this "molecular epidemiology" [9] and I have suggested studies of the molecular biology of the latent period. The latter can take advantage of the identification, in the last 30 years, of high-risk groups, including people who, at least in a statistical sense, are in the process of developing disease, although it is not yet clinically evident.

*Environmental and Occupational Medicine*, Second Edition, contains both the record of what was accomplished in the past and the background from which we now approach the future. It reviews the

scientific information that has emerged in recent years, demonstrating the scope and variety of the research that has been done and the understanding that has been achieved. The chapters range from perceptive analyses of the methods now available to obtain further data and of the mechanisms involved, to examination of the knowledge that today permits early diagnosis and optimal medical management. Equally, these chapters identify agents and circumstances that are associated with risk of subsequent illness and in this way speak to opportunities for prevention of disease, the topic that properly concludes the text.

This volume, 100 years after Robert Koch described the tubercle bacillus [1,2], defines a second epidemiologic revolution [10]. The first revolution showed that infectious agents in our environment could be identified and controlled. Now, the same is being seen at the interface between inorganic matter and the living world. Potentially harmful noninfectious exogenous materials are being discovered, and knowledge is even being gained about dose-response relationships (disease in one of 100 or 100,000? Evanescent rash or fatal cancer?) Again, we look to prevention of such disease, so that we can live in our complex industrial world and enjoy its many advantages while avoiding the harm that can otherwise occur.

Irving J. Selikoff, M.D.

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# Preface

The past two decades have witnessed a revolution in knowledge and experience in environmental and occupational medicine. There has been growing interest in these topics and issues on the part of students, practitioners, and the public. Professional organizations have seen their memberships grow. This textbook was conceived to serve these diverse interests. It has been planned to serve medical students as they enter the clinical years, residents and practitioners as a comprehensive resource, and the public health community as a guide to controlling and preventing disease.

There is a new reason to promote a second edition of this textbook and that is to prod the medical profession into a leadership role in the Green Revolution in the forthcoming years. Not only should the health of our patients be of concern to physicians, but so should the health of our planet. We are going to be 10 billion souls in another generation and we need to address environmental problems now: Do we have adequate numbers and size of nature preserves; can we manage our forests and replant as well as clear-cut; can we help the developing countries protect their tropical rainforests; can we further refine our industrial workplaces and control their effluent; indeed, can we protect our planet from the transnational threats of global warming, ozone depletion, and loss of species? Physicians have a role in preparing society for the future and we need to be in the lead!

*Environmental and Occupational Medicine*, Second Edition, is divided into three parts: an examination of environmental and occupational disease by organ systems; toxicants in the workplace and the environment, selected on the basis of significant hazard or history; and control strategies for both diseases and toxicants.

A textbook such as this one owes its existence to the labors and commitment of many contributors. To them I am indeed grateful. Several chapters were edited with significant changes in style, content, and illustrations in order to produce a comprehensive, timely, and accurate volume. I appreciate the patience and cordiality of the contributors as we progressed through the editing process.

I also wish to thank Kathleen Neville for excellent assistance as Project Director, Ira Warrenfelt and Judy Davanzo for looking up references, and Laurie Anello of Little, Brown and Company, for helping contributors meet deadlines. I would like to acknowledge the support of Saul Farber, M.D., Dean and Chairman of Medicine, Arthur Upton, M.D., and the many individuals in the Institute of Environmental Medicine at NYU Medical Center. Finally, I would like to dedicate the book to my wife Holly and my two daughters Nicole and Meredith, who saw another year of weekends disappear into this effort.

W.N.R.



# Contents

<i>Contributing Authors</i>	xiii
<i>Foreword by Irving J. Selikoff, M.D.</i>	xxiii
<i>Preface</i>	xxv

## I. ENVIRONMENTAL AND OCCUPATIONAL DISEASE

<i>1. The Discipline of Environmental and Occupational Medicine</i>	<i>William N. Rom</i>	3
<i>2. Recognition and Evaluation of Occupational and Environmental Health Problems</i>	<i>Brian A. Boehlecke Robert S. Bernstein</i>	7
<i>3. The Role of Surveillance in Occupational Health</i>	<i>Steven Markowitz</i>	19
<i>4. The Occupational and Environmental History and Examination</i>	<i>Arthur L. Frank</i>	29
<i>5. Epidemiology of Occupational Diseases</i>	<i>Gary M. Marsh</i>	35
<i>6. Occupational Biostatistics</i>	<i>Howard E. Rockette</i>	51
<i>7. Impairment and Disability and the Americans with Disabilities Act of 1990</i>	<i>Alan L. Engelberg</i>	59
 <b><i>Mechanisms of Occupational Disease and Injury</i></b>		
<i>8. Environmental Chemicals and the Immune System</i>	<i>John E. Salvaggio Karen A. Sullivan</i>	69
<i>9. Molecular Biology</i>	<i>David R. Moller</i>	89
<i>10. Environmental Carcinogenesis</i>	<i>Seymour J. Garte</i>	105
<i>11. Environmental Mutagenesis</i>	<i>Gordon K. Livingston</i>	125

12. <i>Strategies for the Rapid Detection and Identification of Environmental Carcinogens</i>	Herbert S. Rosenkranz	135
13. <i>Occupational Exposures and Effects on Male and Female Reproduction</i>	Grace K. Lemasters	147
<b>Organ System: Lung</b>		
14. <i>Particle Deposition and Pulmonary Defense Mechanisms</i>	Daryl E. Bobning Morton Lippmann	171
15. <i>Pulmonary Function Testing</i>	Stuart M. Garay	183
16. <i>Chest Radiography for Assessment of the Pneumoconioses</i>	James A. Merchant David A. Schwartz	215
17. <i>Environmental Pathology of the Lung</i>	Jerrold L. Abraham	227
18. <i>Fiber Analysis</i>	Victor L. Roggli	255
19. <i>Asbestos-Related Diseases</i>	William N. Rom	269
20. <i>Asbestos in Public Buildings</i>	L. Christine Oliver	293
21. <i>Talc and Related Lung Diseases</i>	Morris Kleinfeld Jacqueline Messite Charles P. Giel	301
22. <i>Man-Made Vitreous Fiber, Vermiculite, and Zeolite</i>	Nancy K. Wiese James E. Lockey	307
23. <i>Respiratory Disease in Coal Miners</i>	Michael Attfield Gregory Wagner	325
24. <i>Silicosis</i>	Marvin R. Balaan Daniel E. Banks	345
25. <i>Byssinosis and Other Diseases of Textile Workers</i>	Kaye H. Kilburn	359
26. <i>Hypersensitivity Pneumonitis</i>	Jordan N. Fink	367
27. <i>Inhalation Fevers</i>	Cecile S. Rose	373
28. <i>Health and Safety in the Grain Industry</i>	C. P. W. Warren	381
29. <i>Occupational and Environmental Asthma</i>	Stuart M. Brooks	393
30. <i>Airway Hyperresponsiveness: Mechanisms</i>	Dean Sheppard	447
31. <i>Occupational Exposures and Chronic Airways Disease</i>	Margaret R. Becklake	453
32. <i>Pulmonary and Neurologic Effects of Aluminum</i>	Kaye H. Kilburn	465
33. <i>Pneumoconiosis in Oil Shale Workers</i>	Anthony Seaton	475
34. <i>Benign Pneumoconioses</i>	William N. Rom	479