FELIX GAD SULMAN

# THE EFFECT OF AIR IONIZATION, ELECTRIC FIELDS, ATMOSPHERICS AND OTHER ELECTRIC PHENOMENA ON MAN AND ANIMAL

# The Effect of Air Ionization, Electric Fields, Atmospherics And Other Electric Phenomena On Man and Animal

*By*

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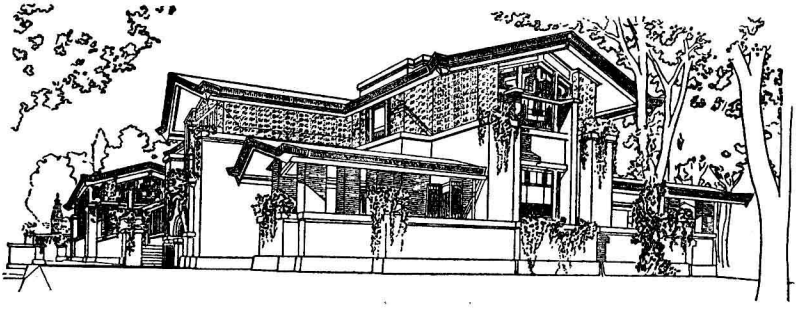

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# The Effect of Air Ionization, Electric Fields, Atmospherics And Other Electric Phenomena On Man and Animal

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AMERICAN LECTURE SERIES®

*A Monograph In*
*The* BANNERSTONE DIVISION *of*
AMERICAN LECTURES IN ENVIRONMENTAL STUDIES

*Edited by*

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*Colorado State University*
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The research and its presentation in this book were made possible by the untiring and devoted help and advice of my wife, Edith, without whom the work could not have been undertaken.

# FOREWORD

## Introduction

DUBOS (1968) has pointed out: "The view that the environment plays an important role in the problems of human biology, medicine, and sociology has never been stated with greater breadth and clarity than it was at the dawn of science in the Hippocratic treatise, *Airs, Waters, and Places.*"

Scholars of the history of biomedical sciences are struck by the thesis in *Airs, Waters, and Places* that humankind under normal conditions is determined in large part by climatic elements of the place where they live. Part of contemporary medical science is comprised of the uncovering and refining of the environmental principles laid out by Hippocrates.

## Air Ionization

An oversupply of ions, whether positive or negative, in the air has been known to bring about demonstrable biological effects. An excess of positively charged ions apparently retards the beat of the cilia in the trachea of mammals. Such positive ions stimulate contraction of the posterior wall of the trachea; the rate of breathing also is elevated. Negative ions in excess are said to produce opposite effects.

"The biological effects ascribed to negative air ions are actually due to negatively ionized oxygen; the effects of positive ions appear to be the result of positively ionized carbon dioxide" (Dill, Adolph, and Wilber, 1964).

There is some suggestion that the biological effects of positive ions are similar to the effects brought about by the action of serotonin, which stimulates smooth muscle contraction and elevated breathing rates.

The plausible relationship between air ion effects and aggravation of such conditions as asthma and bronchitis, for example, seems clear if one looks at the basic biological responses known to occur.

The phenomenon of synergism must not be ignored when considering air ionization and the resulting biological responses in man. The lungs are known to be affected by modifications of the ionic composition of ambient air, but other substances also stimulate the lungs: trace materials such as ozone, gases, particulates, organic and inorganic atmospheric contaminants, decreased effective pressure of oxygen, and temperature stress. These conditions individually have a biological effect on the lungs, but they also interact among themselves and with ionized air. The resultant effects are rarely, if ever, merely additive but are rather synergistic in nature: "A given complex of environmental agents has an individuality and impact of its own over and above those of the several agents of which it is comprised" (Lee, 1972).

It is this phenomenon of synergism that renders so difficult our understanding of the mechanism of action of air electricity in the human organism. Professor Sulman has rendered a valuable service to the scientific community in sorting out the individual actions of a host of atmospheric electrical forces and setting the groundwork for a move into the complex interactions that occur in the earth's air envelope.

In 1968, Tromp summarized the actions of weather and climate on man. In a sense he formulated the substance and borders of bioclimatology.

## Urbanization

It must be recognized that cities play a significant but ill-defined role in the modification of climate. In general, cities cause an elevation of mean temperatures in summer and winter, an overall decrease in relative humidity, a tenfold increase in atmospheric dust particles, a greater cloudiness that may express itself by a 100 percent increase in fog during the winter months, a decrease in total radiation impinging on a horizontal surface, lower wind speeds, calms that are 5 to 20 percent more frequent, and greater precipitation (Peterson, 1972).

The precise extent that a given city modifies climate needs further quantitative research. This need is especially apparent for cities in tropical regions. The downwind influence of a city on

climate merits further intensive, quantitative research. All climatic factors, such as air electricity, have not been investigated with the view to uncovering the role of cities in modifying these factors. It is postulated that a new pattern of synergism is created by cities (as compared with natural or rural settings) for the ambient atmosphere. The quantitative details of this new pattern are lacking; research to clarify the details is warranted.

## Oceanic Influences

It seems appropriate to call attention to the probable but, at present, largely obscure oceanic influences on atmospheric phenomena, including air electricity. For example, an obvious interaction is the fact that sea surface thermal anomalies of 1°C or less exert important modulations on monsoon circulations; these anomalies are also strongly interrelated with precipitation over the adjoining land mass.

Optimistically, an important bonus of the Global Atmospheric Research Programme (GARP) will be a clarification of the critical air electricity phenomena that Sulman reveals are in need of vigorous investigation (UNESCO, 1978).

## Air Quality

In any discussion of air electricity or of other environmental factors that possibly can be controlled by man, it is important to exercise what I prefer to call "self-restraint." This concern has been expressed in an emphatic manner by Scorer (1972):

> It is most unsatisfactory to set standards of air quality. The medical and other biological evidence is so complicated that thresholds and limits of tolerability simply cannot be set. Even if they could be set, it would not be possible to decide what sources should be permitted because their effects cannot be properly forecast. Even if they could be completely predicted, there is not the same kind of reaction among all sufferers. . . . But even if every potential sufferer could be protected, the blame could not be properly assigned if a noxious incident did occur because there is never enough data to make a reliable analysis after the event.

Another point Scorer brings out is that whenever standards are set by governmental fiat, these standards in essence become absolute goals. Industry, governmental officials, and police agencies all look to the standards, ignoring values that are less

than the standard even if it becomes obvious that these lower values are hazardous. "Perhaps most serious of all the objections to the establishment of air quality standards is that they create a situation in which complaint against lesser pollution loses all judicial and even moral force. The community is condemned to suffer the maximum permissible forever. It is better to give the community the right to insist that every polluter does all that is currently possible to minimize pollution . . ." (Scorer, 1972).

Another point that should be kept in mind by individuals concerned with factors in the atmosphere that may have biological action on man is the necessity for treating every locality as an individual entity. The fact that one has worked out in some detail the pattern of atmospheric variables for one city or valley or mountaintop in no way justifies the use of that pattern to describe what may be happening in another locality. The vagaries of weather are such that modeling of local weather systems and local climatological characteristics is fraught with danger.

These cautionary remarks are not made in a pessimistic tone but, rather, are presented as prudent guidelines so that one will not expect too much of a universal or generalized nature from studies such as are so brilliantly summarized in this present volume. One must recognize that in the real world of atmospheric science, things are not simple and situations are more often unpredictable than they are predictable. Recognition of these facts does not mean that we shall never have a deeper understanding of such atmospheric factors as air electricity. It merely means that we are faced with a longer period of intensive research to arrive at generalizations that have use for predicting the future. Indeed, some of these generalizations may have limits of reliability that are wider than we would like, but if that is the way the real world operates, then that is the way we must recognize it.

## Historical Implications

There is a growing swell of critical reevaluation of the validity of our radio-geochronology endeavors because of the serious questions with respect to decay of radioactive elements as a reliable yardstick of past time.

Air electrical phenomena in the past may well have set the radioactive clock, as it were. What validity would our dating system have now if there had occurred subsequent alterations in the state of electrification of planet Earth? One developing postulate involves electrical forces that may significantly modify the precise rate of radioactive decay, which must obtain if radioactive chronology is to work. A sudden drop in the earth's potential by a million or so volts would have widespread and confusing results on our radioactive time clock (Jueneman, 1978).

If these concerns are proven valid then the process of natural radioactivity is more variable than heretofore thought; hence, our "dating game" may need new rules for interpretation as a result of atmospheric electrical phenomena operating through time. The implications of such results are obvious for geology, fossil studies, and evolutionary theory, and indeed, even for the question of modern radioactive clocks used in science and industry for measuring time in what is hoped to be an extremely precise fashion.

## A Final Word

It is hoped that this thorough, reliable monograph on air electrical phenomena, written so expertly by Professor Sulman, will be a useful state-of-the-art summary for a wide variety of readers, in addition to serving as a road map pointing out areas that need further research.

Charles G. Wilber

## References

Dill, D. B., Adolph, E. F. and Wilber, C. G. (Eds.): *Adaptation to the Environment, Handbook of Physiology.* Section 4. Washington, DC, American Physiological Society, 1964.

Dubos, R.: *Man, Medicine, and Environment.* New York, The New American Library, 1968.

Jueneman, F. B.: The dating game. *Industrial Research/Development,* p. 13, April 1978.

Lee, D. H. K. (Ed.): *Environmental Factors in Respiratory Disease.* New York, Academic Press, 1972.

Peterson, J. T.: The climate of cities. In Brittin, W. E., West, R., and Williams, R. (Eds.): *Air and Water Pollution.* Boulder, Colorado Associated University Press, 1972.

Scorer, R. S.: The interaction of local weather and air pollution problems. In Brittin, W. E., West, R. and Williams, R. (Eds.): *Air and Water Pollution.* Boulder, Colorado Associated University Press, 1972.

Tromp, S. W.: Weather, climate, and man. In Dill, D. B., Adolph, E. F. and Wilber, C. G. (Eds.): *Adaptation to the Environment.* Washington, DC, American Physiological Society, 1968.

UNESCO: *Oceanographic Components of the Global Atmospheric Research Program (GARP) Intergovernmental Oceanographic Commission.* Technical Series 17. Paris, UNESCO, 1978.

# PREFACE

THE CONTENTS of this book, *The Effect of Air Ionization, Electric Fields, Atmospherics and Other Electric Phenomena on Man and Animal,* are the result of interdisciplinary studies carried out by a fifteen-man team that has worked together for fifteen years. We would like in particular to mention the devoted collaboration of Drs. M. Assael (Psychiatry), A. Danon (Pharmacology), S. Dikstein (Pharmacology), N. Hirschmann (Biochemistry), Y. Kaplanski (Endocrinology), Y. Koch (Endocrinology), D. Levy (Electronics), A. Lewy, (Statistics), L. Lunkan (Electronics), I. Nir (Pharmacology), Y. Pfeifer (Biology), B. Shalita (Biology), E. Superstine (Pharmacy), E. Tal (Pharmacology), J. Tannenbaum (Electronics) and C. P. Weller (Pharmacology).

The topic of biometeorology is so fascinating that new research students are attracted to it every year, and the circle is growing steadily. This is, in fact, part of a much more extensive research field that has culminated in the development of a Bioclimatology Unit in our Medical School.

Our work in this sphere was initiated by a generous grant from the Florina Lasker Fund for the Research of Man in the Holy Land, administered by Professor Kalman J. Mann, Director of the Hadassah Medical Organization, who is still the chief promoter of our work. During the course of the research, the United States Department of Health, Education and Welfare, through its branch of Environmental Health Services, has helped our studies by Agreement # 06-005-3, administered by Dr. A. Henschel, Cincinnati. At a later stage the United States Office of Aerospace Research helped us with a considerable grant. Then, during the period of recession, we were supported by the Amcor-Amron Co. of Tel-Aviv through the kind offices of Mr. S. Goldman. At present, our Bioclimatology Unit enjoys the magnanimous patronage of Mr. Herman and Mrs. Elsie Lane, New York, whose generous help has made the present work possible.

Mrs. Sylvia Farhi has carried out the difficult work of typing the manuscript with great zeal and devotion.

Special thanks are due to Miss Yocheved Sussmann, who has been editing and proofreading our papers for many years past and has now devoted herself to putting this book into proper shape.

Proofreading and linguistic advice has been provided by the untiring efforts of Mrs. Millie Donbrow, to whom our special thanks are due. Proofreading of the electrical section was in the expert hands of our collaborator Dipl. Eng. David Levy, whose invaluable advice guided us in our research work.

Finally, we wish to thank Prof. Charles G. Wilber of Colorado State University, the editor, and Mr. Payne Thomas of Springfield, Illinois, the publisher, and his staff, for all of their invaluable advice and guidance.

As this monograph contains mainly some guiding references connected with the impact of electrical phenomena on man and animals, the reader who wishes to have a survey of biometeorology is referred to the standard books in this field: S. W. Tromp: *Medical Biometeorology* and *Progress in Biometeorology;* further, H. Dolezalek and R. Reiter: *Proceedings of the Fifth International Conference on Atmospheric Electricity, 1974*. German readers will find valuable information in the survey *Biometeorologie* by V. Faust, in the monograph *Unsichtbare Umwelt* by Herbert L. Koenig and S. Lang and in the book *Felder, Stroeme und Aerosole in der unteren Troposphaere* by R. Reiter.

Weather is something one has to live with and in England it is a universal topic of conversation. John Heywood (1497-1580), a contemporary of Henry VIII, known as a dramatist and an epigrammatist, wrote a charming comedy: "Play of the Weather." He called it: "a New and Very Mery Enterlude of All Manner Wethers." The farce describes a worried Jupiter who has been implored to abolish the wanton machinations of Saturne producing cold, Phebus sending heat, Eolus governing the winds and Phebe launching the rain. Hearing the complaints of eight witnesses, Mery-Reporte, the Vyce, Gyntylman, Marchaunt, Ranger, Water Myller, Wynde Myller, Gentylwomen and Lannder, he soon learns that everybody wishes another type

of weather to suit himself. Jupiter feels that he cannot give in to the whimsical demands of each claimant and — after much litigation — decides that the case should be dismissed with costs. Thus, everything returned to the status quo and has remained so ever since.

PROF. F. G. SULMAN, M.D., D.V.M.

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