

## Human Biometeorology and Geopathology

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### Introductory remarks

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There is a curious ambivalence in the discussions on the influence of atmospheric conditions, or simply the influence of weather and climate, on the living organism.

With the increasing pollution of the environment during the last decades, it has been realised that there is a close and indissoluble relationship between the environment and the living world and that the indirect effects of the atmosphere play an essential role in it. The direct effects however, were and are still met with far more skepticism. The devastating results of weather conditions on crops in the fields are visible and thus accepted, but the relationship between weather and climate and the function of the human body is often considered as belonging to folkloristic tradition.

Indeed, the flights of human imagination on these fascinating problems have lessened the chance of an objective evaluation of such a causal relationship. In addition, the enormous complexity of both the atmospheric system and human physiology have led to the impression that a possible relationship between them is a problem of insoluble intricacy.

Yet in the twentieth century, a vast amount of literature has appeared which reflects the endeavours to unravel these problems, and which demonstrates beyond doubt the impact of the weather and climate on animals, humans and plants. This field of research became known as bioclimatology, which was later changed to biometeorology and subdivided into three main branches: zoological, human and phytological biometeorology.

Before World War II the literature on human biometeorology dealt mainly with the results of a wealth of (clinical) observations. In particular, the extensive studies of W. Petersen: 'The Patient and the Weather'<sup>9</sup>, B. de Rudder: 'Grundriss einer Meteorobiologie des Menschen'<sup>2</sup> in the medical field and E. Huntington: 'Civilization and Climate'<sup>5,6</sup> contributed highly to the credibility of biometeorology.

After the war biometeorology developed rapidly, mainly as a result of the many articles from the Anglo-Saxon

countries on the physiological aspects of meteorological influences. They dealt, for instance, with: thermal, radiation and high altitude effects on hormonal functions, blood composition and circulation; effects of trace elements and air pollution on the respiratory system; effects of electrostatic and electromagnetic fields on the nervous system, biological rhythms, etc. Equally, the atmospheric sciences progressed enormously, not in the least due to the results of space research.

It became clear that to tackle the many problems the joint efforts of scientists of various disciplines are needed. With the founding of the International Society of Biometeorology<sup>1</sup> in 1956, biometeorology became an independent border science and was defined as '*the study of the direct and indirect effects (of an irregular, fluctuating or rhythmic nature) of the physical, chemical and physico-chemical micro- and macro-environments, of both the earth's atmosphere and of similar extra-terrestrial environments, on physico-chemical systems in general and on living organisms (plants, animals and man) in particular*'.

The first substantial textbook (with 4382 references) contributing towards a better understanding of the physiological mechanisms involved, was S. W. Tromp's 'Medical Biometeorology' (1963)<sup>12</sup>, followed in 1974 by the first volume of 'Progress in Biometeorology'<sup>13</sup>. Since its publication in 1957, the International Journal of Biometeorology is the authoritative scientific journal in the field<sup>7</sup>.

Notwithstanding the spate of publications, many scientists outside the field are ill-informed about the progress in biometeorology. EXPERIENTIA's idea of publishing a series of articles on the influence of meteorological conditions on humans is valuable because it offers the opportunity to reach a wider audience than is possible through specialist channels.

At my suggestion another aspect of environmental influence has been added to this series, namely the influence of the lithosphere as counterpart to the atmosphere. Although these influences are closely interrelated, the purpose of this division is to give more publicity to the

relationship of the chemistry of rocks, soils and water and the human body, and the subsequent geographical distribution of diseases.

The interest in the connection between geographical conditions and human activities is, like biometeorology<sup>1</sup>, very old. Hippocrates refers to it, and in the 11th century for instance Ali Ibn Ridwan comments on the hazards of air and water pollution for human health in Old Cairo<sup>8</sup>. A most exhaustive work, which became a classic, was written in 1883 by A. Hirsch: 'Handbuch der Historisch-geographischen Pathologie'<sup>4</sup>.

A vast amount of literature has been published in the twentieth century. Again it was S. W. Tromp, who in the fifties, together with J. C. Diehl, set the scene for future research with his statistical studies on the geographical and geological distribution of human diseases<sup>3, 10, 11, 16</sup>.

Nowadays societies like the American Society for Environmental Geochemistry and Health and its British counterpart study health problems in connection with soil.

Appearing immediately after this introduction is a series of articles describing the physiological and pathological reactions to meteorological conditions; they are followed by the articles on the pathological influences of soil properties. I realise that the list of subjects covered is far from complete, partly because certain specialists in particular fields were not available, partly because some authors were forced to withdraw from the review. Nevertheless, I hope that the articles in this issue may help to eliminate the skepticism and may serve to stimulate future studies in two fascinating fields of research.

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## A short history of human biometeorology

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*The rainbow, they thought, was the net of the God Beghu Nadaoja, the procreator of "swamp disease", with which he caught his victims; the comets were stars to which evil spirits clung and spread diseases<sup>13</sup>, and earthquakes and the beginning of the New Moon were unfavorable to human fertility<sup>17</sup>.*

We now know that malaria is caused by a plasmodium; that its transmitter is influenced by temperature and rainfall<sup>14</sup>; that many other microorganisms spread disease, their viability depending on air movement, temperature,

and humidity<sup>2</sup>; and that human fertility shows a pronounced seasonality, with temperature and light affecting the production of sex hormones<sup>16</sup>.

The notion that weather influences health and disease is as old as mankind, but conceptions of the nature of these influences and ideas about health and diseases have changed profoundly over the centuries. Whereas primitive man brought order to a multitude of confusing phenomena through belief, modern man produces order through knowledge. Between their belief and our knowledge, centuries have elapsed – the weather-gods have