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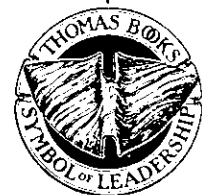
PROFESSOR GIORGIO PICCARDI

*Director of the Institute of Physical Chemistry
University of Florence
Florence, Italy*

The Chemical Basis of Medical Climatology

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CONCLUSION

IT IS NOW TIME to summarize the more salient facts brought to light up to this point and to derive from them some precepts: first of all let us turn back to a subject which was barely touched upon in the introduction.

Living organisms of necessity take part in the events of the environment in which they exist. Very often they participate by means of specialized organs in accordance with their degree of evolution and complexity. But it is not so important for us to know whether the beings in question possess these organs or not, or, if they possess them, whether in greater or lesser number.

The function of these organs is merely for "knowledge," "information" or the "exploration" of their environment and to serve as aides in locomotion, nutrition, defense and so on. All of this is of no use to us so we will concern ourselves with the possibilities offered to living beings of being directly aware of particular environmental phenomena.

The events which take place in space act upon living organisms either *by contact* or at a *distance*.

The air or water in which living organisms find themselves, and therefore all that is contained in these fluids (dissolved or suspended chemical substances, electric charges, etc.), act by direct contact. Air ions, aerosoles, gaseous emanations, free radicals, peroxy compounds, etc., are highly important factors in vital phenomena and this fact justifies the great attention devoted to them today by scholars.

But the study of action by contact, which is accessible to direct experimental investigation, is, as I see it, related more to physiology than to medical climatology. Climatology will be able to add its contribution to the subject, transferring it to its particular field,

after physiology has clarified the mechanism by which action by contact is exercised.

On the other hand, certain phenomena which take place in geophysical space and all of the phenomena which take place in solar space and astrophysical space act at a distance. No matter what the nature of far-off spacial phenomena, their action is exercised by means of radiations of an electromagnetic or corpuscular nature, or by means of variations in the general field, electrical, magnetic, electromagnetic or gravitational. All of this may today be listed as being distant actions.

It is to be noted that these actions, in our case, are able to affect only those places in which living beings under study are found, or else one part of the Earth or, finally, the entire Earth.

With the exception of visible light, which is discernible with the eyes and of infra-red rays (thermal rays), which are discernible on the surface of living organisms, no other radiations are noticed. Organisms undergo them unawares and then discount their eventual effects. The same may be said of variation in the general field.

It has already been stated in the introduction that the modern tendency is to ignore common meteorological factors which are discernible by living organisms (heat, cold, humidity, wind, rain, etc.) as determining factors in medical climatology. Modern climatology tends instead to consider certain biotropic factors, undiscernible by living organisms, accompanying the emission of certain electromagnetic waves, certain variations in the atmospheric electric field, etc.

The interest of modern climatological studies is therefore directed toward factors which are yet unfathomable and which may be studied only with the greatest difficulty in laboratory, and therefore studied with great difficulty in the field of physiology.

At this point I must remind the reader of the fact that, practically speaking, almost nothing is known about electromagnetic fields of low and very low frequency, either from a strictly physical standpoint or from the standpoint of biological application. Long-wave spectroscopic studies are still at an initial stage.

The naturalistic study of low frequency and ultra-low frequency electromagnetic fields is beginning to interest scientists, but a very great deal remains to be done.

I would like to point out that in putting our chemical tests in operation we have not advanced any hypothesis regarding the phenomena which should have been able to influence their results. It was left so that the chemical tests themselves might indicate which were the phenomena which seemed to determine their fluctuation in order to demonstrate later, on the basis of statistical analysis, if the relationships between the test results and the phenomena under consideration were valid.

Up to the present time we have not been able to discern any behaviour in the tests that could be linked to the behaviour of normal meteorological or climatic phenomena in the traditional sense of the word. More precisely, one should say that nothing climatic has been manifested before our eyes with the same evidence as was the case with solar activity and the annual variation of test D, which later gave rise to the solar hypothesis.

This is not to say, of course, that a more profound and more accurate investigation might not unearth a new element, but this element, which has not been evident up to the present, could be of no more than secondary importance compared with solar elements.

This spontaneous graduation of the importance of spacial phenomena as they concern our research will have certain things to teach us; in fact, it will be impossible to study, in restricted and specialized fields, less apparent phenomena if before these the major sun phenomena and the helicoidal motion are not first studied profoundly. Those who have established relationships in restricted fields without taking into account the *great rulers of space* have placed their work in jeopardy.

To be unconcerned with solar activity and the helicoidal motion of the Earth in medical climatology is like being unconcerned with temperature in physical chemistry. Temperature has a strong influence on the course of chemical reactions and it *must* be considered if we want to study any chemical problem. In the same way, we cannot study a biological or medical problem in medical

climatology without taking into consideration *the state of the sun* and *the season* in which the studies are being carried out.

In considering the state of the sun, one must take into account the phase of the current solar cycle, whether it be one of *rising or diminishing activity* because of so-called *hysteresis*, as indicated by the chemical tests, just as it is necessary to take into account the saturation of the effects of the activity, which, too, are clearly revealed by the chemical tests.

Bioclimatological studies should be organized in various ways, depending on the nature of the spacial phenomena under consideration. Solar effects and effects of the helicoidal motion of the Earth should be studied throughout the entire surface of the Earth. This is work which should be carried out with the assistance and collaboration of astrophysicists and geophysicists. The organization of experiments must, in fact, respond to general needs. Special and local effects should be studied in a more restricted locality, always, however, of necessity bearing in mind general effects.

It is for this reason that I stated in the introduction that medical climatology is a general science.

If we are interested in solar effects, it would be well to conduct our research during *a period of maximum solar activity* (as was done during the recent Geophysical Year); if, however, we are interested in the effects of the helicoidal motion of the Earth, and thus the seasonal change from a relativistic-astrophysical standpoint, the dissymmetry between the northern and southern hemispheres of the Earth, or the effects of latitude, it would be best to conduct our experiments during *a period of minimum solar activity*. Solar outbursts do not aid research in this field; rather, they confuse it, superimposing the unmasked-for effects of capricious and inconstant solar activity upon the highly regular effects that should be studied.

Beyond this naturalistic part which constitutes the underlying basis of medical climatology, and which may be studied by astrophysical, geophysical and physio-chemical means (chemical tests), the more *chemical-physical-biological part* is still to be studied, the part which concerns the mechanism by which external biotrophic events set upon water and upon non-biological and biological colloids.

Upon this latter point, studies are not very far advanced. The reasons for this lack of development are two.

One of the reasons is the following: It is only lately, as I showed earlier in the chapter on water, that a satisfactory theory has been formed regarding the structure of water and solutions. The new theory is still being developed and has not got to the bottom of all the problems posed by water and solutions. The fine properties of water and of solutions have not as yet been well-defined from an experimental point of view in the physio-chemical field.

The other reason is this: the influence of radiations upon water, upon solutions and, generally, upon chemical phenomena in aqueous media, has not as yet been thoroughly studied, either from a theoretical point of view or from an experimental point of view. This lack depends in turn upon the fact that *the scale of natural radiations has not as yet been entirely studied*. If the short wave-length scales are sufficiently understood, the long and very long wave-length scales are completely ignored, as I pointed out earlier.

If it is necessary to lay the chemical basis of medical climatology with exactitude, we should answer the following question in a completely general sense:

What is acting from space upon living organisms, and in what way does it act?

The question is simple, but it bears with it a world of things astrophysical, geophysical, physical, physio-chemical, chemical and biological. If, for the sake of simplicity, we disregard actions by contact, those that may be studied in laboratory, the question, taking into account our general knowledge in the astrophysical and geophysical field, can be restated thus:

Upon what do the radiations which strike the Earth and the general variations in the field act?

In order to answer this question, let us review some of the more salient facts which were set out earlier and place them in mutual relationship.

1) We are certain that in the space which surrounds us phenomena occur which influence living beings from afar (and not by contact with material things) by means of radiations or variations in the general field.

2) We are certain that inorganic and organic (non biological!) colloidal systems, in the process of evolution are sensitive to spacial phenomena and make it possible to follow some of these, at least the more imposing of them, with statistical sureness. This has made it possible to successfully make use of particular chemical tests for the study of geophysical and astrophysical phenomena. The connection between spacial phenomena and physical-chemical (non biological!) phenomena is by now firmly established.

3) Modern theory, the best and most refined, attributes to water and thus to solutions and thus again aqueous colloidal systems, a structure which offers infinite possibilities of geometric and energetic variation. It is from this, at least in principle, that the fine properties of water, colloids and solutions are derived; those fine properties that hydrologists and biologists know so well but which physical-chemists and chemists do not recognize or—perhaps more precisely—are not capable of identifying in their work.

4) It is reasonable and logical to recognize the geometric and energetic element, sensitive to external radiations and to general variations in the field, in the structure of water, aqueous solutions and colloidal systems in an aqueous medium. A few words on this subject would not be amiss.

First of all it is necessary to distinguish the action of a corpuscular radiation from the action of an electromagnetic radiation and from that of a variation in the field. Particles strike at random and their action is sporadic and limited to the zone which is struck.

The action of particles never involves the whole mass of a body nor, therefore, of an organism. Electromagnetic radiations and field variations, however, strike the entire mass of a body, and thus of an organism, and provoke the oscillation, excitation or, at any rate, the resonance, so to speak, of all the structural elements capable of responding to their stimulus, wherever they are found. Their action is total.

In other words, those elements which, depending on their dimensions, their geometric form and their internal energetic relationships, are able to resound to radiations of appropriate frequency, are the structural elements. There can be no resonance without precise spacial energetic distribution. Therefore, there can be no resonance without structure.

Definitely, all living matter reacts to far-off spacial actions, both electromagnetic and field.

Returning to the colloidal systems used as chemical tests, it is best remembered that these were *not living* colloids but were *inorganic* colloids (oxychloride of bismuth) or *organic* colloids (acrylonitrile). There can then be no doubt regarding the physical validity of the discovered relationships, not even from a theoretical standpoint.

That which reacted to spacial actions was, in our case, *dead matter* and was thus exempt from vital processes and from hereditary, constitutional, pathological factors and so on. The unknown factor, "life," played no part in our operations.

The reaction of dead matter is both pure physical reaction and a physical action and is thus perfectly dependable, controllable, experimentally reproducible and comprehensible, at least in principle.

On the other hand, living matter reacts to spacial actions like dead matter. This shows us that the sensitive part of living matter is its *non-living substratum*: water and the colloids dispersed throughout. I am not sure whether the expression is exact, but "non-living substratum" renders the idea clearly.

This is not a supposition but a logical deduction. If inorganic colloids in aqueous media and in evolution, that is, not yet having attained a state of thermodynamic equilibrium, react in a marked manner to major spacial phenomena, how could biological colloids, which are also colloids in aqueous media and not in a state of thermodynamic equilibrium, refuse to react? If a living colloid were to attain a state of thermodynamic equilibrium it would no longer be living since it would be incapable of any transformation or any evolution and could not be host to vital phenomena.

Experiments corroborate the deduction I have just mentioned, because they have clearly shown that the same fluctuations revealed by inorganic colloids are *simultaneously* revealed also by biological colloids. The data which have been gathered speak clearly: there can be no doubts of any consistency.

It could be objected that living matter, unlike non-living matter, would do its utmost to maintain its conditions of life or to

re-establish them, whenever these should be altered. It could be, therefore, that the reaction of living organisms to spacial actions would be less conspicuous than that of inorganic colloids. The effects of spacial actions will be compensated in some manner and so rendered less apparent. But conserving or renewing vital conditions is also a reaction to external actions and is consuming and troublesome: it is the suffering of *all the matter* comprising an organism because, as I have said earlier, the actions strike all of the living matter by means of the non-living substratum. It could also be, in certain cases, that the organism does not reveal visible alterations, but how much would not revealing any reaction have cost it?

And now, a final consideration:

The fact that living matter reacts to spacial actions like non-living matter, because what reacts is its non-living substratum, is something of major importance, as I see it.

It is to be borne in mind for general reasons, because we are thus assured that whatever living being, an animal or plant, unicellular being or superior organism there be, is destined to be subject to the general influence of spacial events. All living beings are bound more intimately to the external world than one would think.

It is also to be borne in mind from a methodological standpoint, since it provides us with the hope of being able to study the phenomena of medical climatology *on inorganic models*, as pointed out earlier. Chemistry offers an infinity of inorganic models of highly varying types which we might be able to utilize in the most disparate circumstances for the study of various natural phenomena.

And, finally, it must be taken into account from an ecological-climatic point of view because everything that is made up of water or which contains water, solutions, colloidal solutions, suspensions, is subject to the same spacial actions as are living organisms, and is modified as a result. Thus the water of rivers, lakes, seas, marshes and ponds, their inorganic, organic and biological colloids, clay, sediment, mud, in short all that is found in a dispersed state and which has not yet attained a state of thermodynamic equilibrium.

Even this is not a supposition, but a deduction based on experimental facts. Mosetti has observed, on the basis of Vercelli's periodical analysis, that a very great part of major natural phenomena, considered as functions of time, are subject to a general law. Their fluctuations may be broken down into a series of periods whose lengths arranged in order of size, form a geometrical progression whose rate is $\sqrt{2}$. Solar spots, raininess, certain sicknesses, sediments in lakes and marshes, varve, magnetism, etc., act in the same manner. This means that all of these phenomena, so dissimilar, are either all mutually connected or else they all depend upon the same major spacial occurrence which effects them all, both with eventual de-phasing and with varying intensity, the same rhythmic characteristics.

If the ideas postulated herein are acceptable, spacial action, from a climatic standpoint, should be two-fold: 1) directly striking the living organism; and 2) modifying its environment.

Spacial action reacts upon the inner world and, at the same time, upon the outer world. So that the modified organism finds itself in a modified environment. The inner world (*Inwelt*) and the outer world (*Umwelt*) react jointly to the major spacial phenomena.

The foregoing is no more than an attempt to give a chemical basis or, more precisely, a physical-chemical basis to medical climatology. It does not seem possible to say more at this moment in view of the present state of climatic studies and physical-chemical studies of the fine properties of water, aqueous solutions and colloidal solutions. The latter studies are still in the process of development and great hopes are attached to their future.

Anyone with sufficient patience to have followed this exposition will have noticed that I have set out certain facts of a varied nature in order to form from them a logically connected and interdependent whole, notwithstanding the great disparity in these facts. I used the word "facts," meaning by this established and certified facts. I had no desire to advance a hypothesis which was not based on experiment.

I realize that this has not been a complete exposition; I am equally aware that I have stripped my presentation of all argu-

ments that were not absolutely essential to the aims of this report. I am also aware that I am far from solving the problem set before me, but I hope to have at least been able to indicate a direction capable of guiding whoever should wish to concern himself further with this intriguing study.