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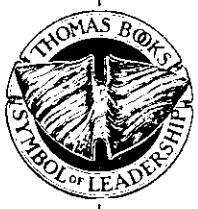
The Chemical Basis of Medical Climatology

CHARLES C THOMAS • PUBLISHER
Springfield • Illinois • U.S.A.



Chapter VI

ON THE MECHANISM OF SPACIAL ACTIONS

BEFORE CONCLUDING this exposition it would be at least necessary to state generally the problem of the mechanism of spacial actions. I say state and not resolve because at the present moment it does not seem possible to resolve the problem.

It is evident that the mechanism according to which the spacial phenomena act at a distance (not those which act upon contact) consists of two parts: 1) a *mechanism of short path* or of entrance of spacial actions into the living organism; and 2) a *mechanism of long path* or of diffusion of spacial actions, eventually accompanied by the transformation of the action itself.

The mechanism of short path regards physiology more than climatology, just as the mechanism of actions upon contact, studiable in the laboratory regards physiology more. It is not my task to speak of these mechanisms.

I should like however to note the importance in this field of the ionization of air, an importance which justifies the many studies which are being carried out in it.

Regarding the mechanism of long path, it would seem opportune to take note of that which Berg has already synthesized in his last work, that one with which he concluded prematurely his life. I shall recapitulate it, conserving the original train of thought.

De Rudder had discovered various relationships between solar phenomena and biological phenomena, between biological phenomena and meteorological phenomena, and between meteorological phenomena and solar phenomena. Admitted that the existence of this closed cycle be real, it would be extremely difficult to separate the effects of the solar actions from the effects of the meteorological actions, given that the meteorological phenomena are in relationship with the solar phenomena upon which they would depend. It would be then most difficult to know which of

the two types of phenomena is that which gives preponderant effects, which is thus the more *biotropic*.

But today, as was noted, a correspondence between solar and meteorological phenomena *is not significant* in the light of modern statistics, and, however certain it be, that the sun has a great hand in atmospheric phenomena, of which it is the primary cause, the variations of solar energy transmitted to the Earth do not account for the multiplicity of phenomena which one notes in our atmosphere. The lack of correspondence between the fluctuations of energy radiated by the sun and the complex meteorological phenomena, obliges one to consider separately solar and meteorological actions.

Solar actions reach us as electromagnetic radiations of various frequencies and as corpuscular radiations. The problem remains as to their reaching us as variations of the general field. One could respond affirmatively, thinking, for example, that the cloud of particles launched towards the Earth from a solar eruption, carries with it the magnetic field (I was not speaking of fields generated upon the Earth from eruptions as secondary effects, but those solar ones or ones provoked by the sun).

Solar radiations can act upon organisms either directly or indirectly through secondary phenomena generated by the radiations themselves. From the secondary phenomena one must, of course, exclude the meteorological, for the reasons already cited.

Duell set forth the hypothesis that bursts of ultra-violet solar radiations generate high tensions in the stratum D of the ionosphere, in the ozonosphere, and in the troposphere. These high tensions, leveling themselves, would give origin to electromagnetic waves of great length. The electromagnetic waves would become directly absorbed by living organisms, disturbing the neuro-vegetative system. But this regards the mechanism of the shortest path.

Again, according to Duell, corpuscular radiations would not have such an important and certain action as the electromagnetic ones do (and I add: *there*, where we live on the outer surface of the Earth). On the other hand, according to Duell, secondary phenomena caused by these corpuscular radiations (electrons,

gamma rays, traces of chemical substances, etc.) can have a biological action.

To the electromagnetic radiations of great wave length generated in the terrestrial atmosphere by solar radiations are added the electromagnetic radiations of short wave length generated from the sun itself.

Waves from 1 cm to 20 m radiate constantly from the solar corona. Spots, eruptions and disturbed zones of the corona during periods of disturbance, generate these same waves with an intensity thousands and thousands of times greater.

There existed therefore a certain interest to find out if these waves possessed a biotropic action. But the biotropic actions of these waves did not remain very clear or at least evident. Kiepenheuer, Harte and Brauer experimented with the action of waves of 1.50 m upon buds of *Vicia Faba* and observed a certain effect: an increased frequency of cellular division. The experiments were carried on by Harte and Brauer.

Afterwards Elvert, Reinert and Mitlacher searched in vain for an effect of metric waves on biological specimens: germination of seeds from *Digitalis lutea* or of spores from *Aspergillum niger*.

It is difficult to reach a conclusion from these results: the biological tests, the experimental conditions, and likewise the period of time during which they were conducted differ. This last circumstance is of the utmost importance. And still, at that time, no one knew of the effect of the metallic screen.

It should be noted that this first step was taken by an eminent astrophysicist who collaborated directly with biologists. The first and the last links of the biotropic chain were joined by them.

The effects of the short waves do not seem for the moment a field that interests many. At any rate the interesting one is that of the long waves.

According to Berg, the chemical tests brought a clarifying element to today's situation. They demonstrated more than exhaustively that inorganic colloidal systems in aqueous media are influenced above and before all by solar phenomena. There is no doubt of certainty of the relationships discovered because that certainty is founded upon most rigorous statistical analysis.

I add that it is true for inorganic and organic colloids, and seems true identically for biological colloids. One has therefore a reason for insisting that also in medical climatology the phenomena that react with greater certainty are the solar phenomena. The mechanism of long path in this case is that of propagation and transformation of solar radiations.

On the other hand, the effect of the metallic screen on chemical tests, that is upon colloidal systems in evolution, confirms that solar action is above all of radiant nature. If the thinnest sheet of metal is enough to change considerably the mode of precipitation of an inorganic compound, one must admit that the spectrum of incidental radiations can be modified at least in part by modifying the sheet of metal itself. The metallic screenage reflects or absorbs some of the components of the incidental radiation.

The fact that a simple roof of metallic lustre or also of metallic net placed above the system to be tested, changes the precipitation of colloids of the system itself, shows us that the action exerted *is not an action of contact* (as in the case of chemical substances or of electrical charges contained in the air) but is actually the action of a radiation or of a field. We must note this does not concern visible or ultra-violet radiations or those of the shortest wave-length.

Since the short waves, that is the electromagnetic high frequencies, do not give free play to biological researches, it is well to direct our attention to the field of low and ultra-low frequencies.

On the other hand, modern radio technique permits us today to follow the variations in the intensity of the ultra-violet and roetngen solar radiations that fall on the upper atmosphere, on the basis of the very low frequency radiations intensity.

Studies of the VLF in relation to the polar auroras are going on in the Antarctic.

One notes that sudden increases of intensity in the atmospherics are attributed today to astrophysical causes. These sudden disturbances correspond to flares. Methodical recordings were made at the Wilfred Hall Observatory at Preston on the part of Prof. Barocas, director of the same.

At Munich, Schumann, considering that the Earth and the ionosphere that circles it constitute a kind of concave spherical resona-

tor, calculated its resonance frequency and found a frequency of about 10 Hz. Koenig, on the basis of Schumann's calculations, conducted research in the field of new techniques for the radioelectric measurements with the intention to receive the natural ultra-low frequency signals coming from the space around. Koenig was able to gather signals between 1 and 25 Hz. and to record them regularly, ascertaining among other things a most notable diurnal effect.

The studies of the Munich school brought about a great interest among the biologists. The ultra-low frequencies seem in fact to produce remarkable biological effects (Koenig, Reiter, etc.). It is perfectly logical:

If, in the case of the very light molecules (for example: those of ammonia), the high frequencies are able to generate effects, already well noted, in the case of the very large molecules, or very large micelles or very large and deformable structures, the high frequencies have probably little or no effect. Instead the low and ultra-low frequencies can have it.

The biological systems are therefore vulnerable to the low frequencies because they are all constituted of colloids in aqueous media which are in turn made up of very large molecules or micelles suspended in molecularly structured aqueous solutions.

The preceding considerations have conducted us into a completely new field, that one of very low frequencies. It will be in this that we shall find perhaps one of the roads which will conduct us to the solution of some of the problems of medical climatology. But the field is new and unknown as yet and we find ourselves to be quite at sea, deprived of the benefit of direct and old experience.

I must conclude for now, affirming that as premature as is the talking about the mechanism of spacial actions for me as a chemist, at any rate it was necessary to point out the situation in this field.

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