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CONTENTS

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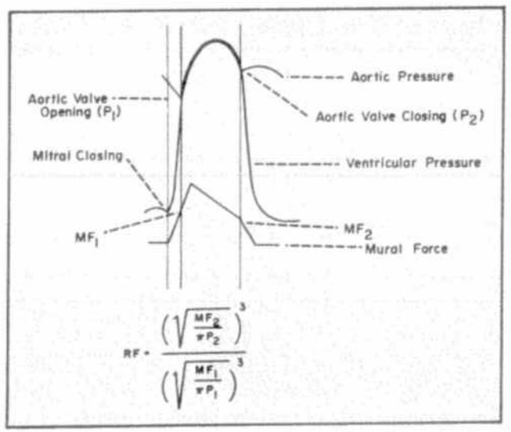

Idealized cardiac blood pressure and mural force traces to show points yielding equation values.

See page 503

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ANATOMICAL LOCALIZATION OF HUMAN DETECTION OF WEAK ELECTROMAGNETIC RADIATION: EXPERIMENTS WITH DOWSERS*

ZABOJ V. HARVALIK**
5901 River Drive, Lorton, Virginia 22079

• *Positive responses (dowsing signals) were evoked from 14 male "dowsers" by exposure to artificial electromagnetic (ac) fields. When the kidney area was shielded, such responses failed to occur. This suggests that magnetic sensors exist in man, probably located in the renal vicinity. Extinction of response was also observed when the head was shielded. This suggests the existence of additional magnetic sensory apparatus in the brain. Discrimination among magnetic patterns (signatures) is hypothesized to account for the apparent ability of dowsers to find specific underground substances, notably water. Such discrimination would require functional association of the sensory apparatus with a signature processor. Data are presented suggesting that this sensor-processor complex does indeed exist and may be located in the vicinity of the pineal gland.*

INTRODUCTION

A paper presented at the 48th annual meeting of the Virginia Academy of Science reported that certain overt physical responses known as "dowsing signals" were obtained from human subjects by exposing them to an artificial magnetic (dc) field.[1]

As background it should be mentioned that in numbers of areas throughout the world, individuals called "dowsers'" are relied upon to find water. Formerly the dowser would traverse a given sector while carrying a pendulum or gripping a forked limb or staff; today the dowser customarily holds an L-shaped rod in each hand. The expectation of dowser and client is that when and if underground water is approached, the L-rods will move in a characteristic way (see EXPERIMENTAL, below). This response, said to signal where a successful well can be sunk, is what dowsers term the "dowsing signal."

* Presented in part at the 54th Annual Meeting of the Virginia Academy of Science, Medical Sciences Section, George Mason University, Fairfax, Virginia, May 14, 1976.

** *Biographical Note:* Dr. Harvalik was born in Yugoslavia and educated in Czechoslovakia. He received a Ph.D. in physical chemistry from Prague University. Formerly Associate Professor of Physics at the University of Missouri and Professor of Physics at the University of Arkansas, he has been director of the basic research group of the U.S. Army Engineering Laboratories, Fort Belvoir, Va. Since his retirement in 1973, he has continued to pursue his lifelong hobby: the study of the physics of dowsing; i.e., the mechanism by which so-called dowsers reputedly find underground water and other substances.

In the experiment cited above,[1] only a few of the approximately 300 subjects claimed any dowsing ability. Many had never heard of dowsing. The object of the experiment was to investigate the possibility of human sensitivity to low-power magnetic fields, using the dowser's technique of visualizing response by means of L-rods. Accordingly, a low-power magnetic field was produced by connecting an electric power supply (either ac or dc) to 2 electrodes implanted in the ground 20 m apart.[2] When the current was activated, 80% of the subjects displayed dowsing signal with the L-rods each carried while traversing the "dowsing zone"—i.e., the artificial magnetic field. When the current was inactivated, none displayed signal. These results seemed to imply the existence of a magnetic sensor or sensors in the human body.

Subsequent attempts were made to locate the postulated sensors by shielding subjects with magnetic shielding material such as Co-Netic AA sheets.[3] In this case the subjects were self-styled or reputed dowsers. When a sheet 30 cm wide was wrapped around a subject's body at the level between umbilicus and sternum, no dowsing signal was observed as he walked over the dowsing zone induced by ground-implanted electrodes. Kopp[4,5] reported that a dowser carried over a dowsing zone on a stretcher displayed signal when his upper abdomen passed over that zone. However, neither my own nor Kopp's experiments[3-5] permitted more than the gross placement of sensitivity somewhere above the navel and below the sternum, without indication of lateral or anterior-posterior position.

Accordingly, the present experimentation was undertaken. Its twofold purpose was (a) to confirm further the phenomenon of magnetic sensitivity in the human body, and (b) to determine more accurately the anatomical placement of the sensory mechanism(s).

EXPERIMENTAL

Basic methodology. Procedures used stemmed from results of a prior study[6] demonstrating that representative dowsers display signal upon exposure to electromagnetic fields in the frequency ranges of 1 Hz to 1 MHz and beyond. It followed that since hf beams are markedly attenuated by metal shielding, an experimental system could be devised utilizing a low-power hf generator (hfg), a randomizer to switch the beam on and off, and aluminum sheeting to shield selected body areas.[7]

Subjects and trials. Fourteen persons participated in the experimental trials, all reputed to be dowsers and/or representing themselves as such. Persons of possible or probable dowsing capability were chosen for the study because optimum sensitivity was considered preferable; data from persons of little or no sensitivity could mask the existence of sensors or their location. Of the selected 14, one participated in 262 trials, one in 96, one in 72. The remaining 11 subjects participated in 24 trials each. Total number of trials was 694.

Initially, two or even three subjects participated in the same trials (same settings

of the randomizer). This was abandoned in favor of "one participant only" for each trial to avoid possible transference effects (visual or otherwise). However, it should be noted that the participants were separated throughout the trials and only after all runs were completed did the group witness read-out and tabulation of the data.

One noteworthy subject was Wilhelm De Boer of Bremen, West Germany, a professional certified by German authorities. (In Europe, as in the Soviets, dowsing activity is much more formally organized than in the U.S. Germany, for example, supports an accredited Academy of Dowsing.) De Boer has an international reputation among observers and practitioners of dowsing. His sensitivity to artificial magnetic fields had been found earlier to exceed by several orders of magnitude that of all persons tested by me;[8] moreover, astounding as it seems, drinking 2 glasses of water temporarily increased his sensitivity approximately 10-fold.

Electromagnetic field. During all trials, the hfg was mounted on a wooden surface 90 cm above ground level. The 5-cm beam width at origin dispersed at a cone angle of 17°. Thus at 2.5 m, the distance from hfg to the path, the axes of the generator coils were horizontally adjusted to point perpendicularly to the path to be followed by the subjects. Hence one side or the other of each dowser would be exposed to the beam according to the direction in which he negotiated the path. Also, he could turn so as to expose front or back to the beam. At 2.5 m, the perpendicular distance from hfg to path, the electromagnetic field could be aimed to cover the kidney area without overlapping the brain area, and vice versa.

De Boer's sensitivity was great enough to permit operation of the hfg in the frequency ranges of 42.83 MHz (= wavelength of 7 m) and 58.55 MHz (= wavelength of 5.12 m) at microwatt power. (During the trials of the other 13 subjects the hfg was operated in frequencies varying from 58.55 MHz to 6 GHz.)

Separation of the magnetic component of the radiation from the electric component as the source of subjects' reactions was achieved as previously reported.[9]

Shielding. Attenuation was by aluminum sheet 0.4 mm thick and 5 cm wide, cut into lengths of 83 cm, 55 cm or 14 cm respectively designated "belts," "crowns," or "flaps." During the De Boer trials, considerable attenuation was also obtained by using aluminum wire 3.5 mm in diameter.[10] In separate trials the belt was worn around the body at levels ranging from pelvis to armpits, or one flap or two flaps were worn so as to cover a kidney or kidneys, or the crown was worn on the head at various levels and angles.

Randomizing. Double-blind experimental conditions were established by inserting a randomizer into the electrical (plate) circuit of the hfg. Neither subjects nor experimenter could know (except by dowsing reactions) when the hfg was radiating or not radiating. The randomizer has been previously described.[7] As the trials proceeded, the randomizer continually and unpredictably varied the sequence of beam *on* and beam *off*. During De Boer's 268 trials, for example, the randomizer was re-

programmed 57 times. The programs varied from 10 *on*-2 *off* to 3 *on*-9 *off*, the average being 6 *on*-6 *off*.

L-rods. All subjects held an L-rod in each hand while undergoing a trial. Dowsers use L-rods of metal or non-metal, but those relied on in the present study were aluminum wires 3 mm in diameter bent into L-shape. The shorter leg was 15 to 20 cm long; the lengthier leg about 40 to 60 cm long.

Scoring. To prepare for delivering signal, a dowser customarily carries an L-rod in each hand, holding it by the shorter leg. He sets the longer legs of the 2 rods into a parallel position, the tips slightly depressed. The typical dowsing signal is a movement of the arms particularly in the elbow area (but not primarily a movement of the hands) that causes the rods to cross (converging mode) or spread apart (diverging mode). Whether the rods converge or diverge seems to depend on how the dowser had adjusted them to the parallel position.

In the present study, only these characteristic rod conformations were accepted as signals, although some were designated "weak." A record was kept of each subject's dowsing signal or lack of it as he traveled the target path and returned, oriented his stance so as to expose front and back as well as sides, and wore shielding at selected body locations. An observed signal was scored as *yes*. Lack of signal was scored as *no*. After completion of trials, this record was compared to the randomizer read-out as to beam *on* and beam *off* sequences. Where *yes* coincided with beam *on*, and where *no* coincided with beam *off*, a "hit" was scored. Where *yes* coincided with beam *off*, and where *no* coincided with beam *on*, a "miss" was scored. However,

TABLE I. Response to hf Beam by Subject Shielded with Aluminum Flap.[a,b] (Beam reached subject at his left side.)

Trial number	hfg	Dowsing signal	Distance of shield from spinal column (cm)[c]
1	*on*	weak	15
2	*on*	weak	20
3	*on*	yes	25
4	*on*	yes	30
5	*on*	yes	35
6[d]	*on*	yes	13
7	*on*	weak	15
8	*on*	no	17[e]
9	*on*	weak	20
10	*on*	yes	22
11	*on*	no	17[e]
12	*on*	yes	no shield worn

[a] Operator of hfg knew beam was *on* throughout this trial series, hence experiment was not double-blind. It served only to fix approximate location of optimum shielding effect. [b] For dimensions of flap, see text. [c] Flap attached to subject at kidney height was moved progressively around waist starting from 15 cm left of spinal column vertical midline. [d] Following Trial 6, subject rested 10 min. [e] Optimum shielding locations: 17 cm to left and 17 cm to right of spinal column midline.

TABLE II. Response to hf Beam by Subject Shielded with Aluminum Flap.[a] (Beam reached subject at his back.)

Trial number	hfg	Reaction	Distance of shield from spinal column (cm)[b]
1	*on*	yes	5
2	*on*	weak	10[c]
3	*on*	yes	15
4[b]	*on*	yes	20
5	*on*	yes	5
6	*on*	yes	7
7	*on*	weak	10[d]
8	*on*	yes	12
9	*on*	yes	15
10	*on*	yes	20
11	*on*	weak	10[e]
12	*on*	yes	7

[a] Same conditions as in Table I, except flap attached to subject at kidney height was moved progressively around waist starting from 5 cm left of spinal column vertical midline. [b] Following Trial 4, subject rested 10 min. [c] Optimum shielding locations: 10 cm to left and 10 cm to right of spinal column midline.

where shielding effect was operative, *no* coinciding with beam *on* was scored as a "hit."

Only data obtained under double-blind conditions were accepted for scoring. Some data were developed single-blind solely to determine optimum shielding placement (Tables I, II); these results were not given "hit" or "miss" designations.

RESULTS

Of the total 694 trials, 691 scored as hits and 33 as misses.

Of the trials related to proposed sensor location in the kidney vicinity (belt or flaps placed to intervene or not intervene between kidney and hfg with latter either *on* or *off*), 332 scored as hits and 15 (4.5%) as misses.

Of the trials related to possible sensor location in the brain, 329 scored as hits and 18 (4.8%) as misses.

Tables I-VI have been excerpted from the research protocols. These tables set forth typical details and results for the trials of an individual subject. Specifically, the tabulated data pertain to De Boer, and are atypical only in that his exceptional sensitivity enabled him to respond to exceedingly low-power hf radiation (microwatts) rather than the somewhat higher power and longer wavelengths (milliwatts) used to evoke equivalent results from the other subjects. The De Boer data is selected for presentation here because (a) he participated in the greatest number of trials, and (b) these data are of unique interest because of his superior magnetic sensitivity.

During successive trials, this subject wore a belt moved through successive levels from armpits to pelvis. When he was targeted laterally with the hfg activated, dowsing signal was observed for all belt locations except that which covered the kidney area. These observations were also made when he approached or receded from the beam at different angles (Table III).

No signal was observed when a single flap was worn somewhat above the waistline

TABLE III. Response to hf Beam by Subject Shielded with Aluminum Belt.[a] (Beam reached subject at his front.)

Trial number	hfg[b]	Dowsing signal	Score	Part of body shielded
1	*on*	yes	hit	no shield worn
2	*off*	no	hit	no shield worn
3	*off*	no	hit	kidney area
4	*on*	yes	hit	no shield worn
5	*off*	no	hit	no shield worn
6[c]	*on*	no	hit[d]	kidney area
7	*off*	no	hit	no shield worn
8	*on*	yes	hit	pelvis area
9	*on*	yes	hit	pelvis area
10	*off*	no	hit	kidney area
11	*off*	no	hit	heart area
12	*on*	yes	hit	heart area

[a] For dimensions of belt, see text. [b] hfg = high-frequency generator. [c] Following Trial 6, subject rested 10 min. [d] Scored as "hit" because of apparent shielding of sensors in kidney areas.

TABLE IV. Response to hf Beam by Subject Shielded with Two Aluminum Flaps.[a] (Beam reached subject at his rear.)

Trial number	hfg	Dowsing signal	Score	Part of body shielded
1	*off*	no	hit	no shield worn
2	*off*	no	hit	back[b]
3	*on*	no	hit[c]	back[b]
4	*off*	no	hit	front[c]
5	*off*	no	hit	no shield worn
6[d]	*off*	no	hit	back[b]
7	*on*	yes	hit	front[e]
8	*on*	yes	hit	no shield worn
9	*on*	no	hit[c]	back[b]
10	*off*	no	hit	back[b]
11	*on*	yes	hit	front[e]
12	*on*	no	miss	front[e]

[a] For dimensions of flaps, see text. [b] A flap was worn over each kidney area; i.e., about 16 cm left and right of spinal column vertical midline. [c] A flap was worn about 16 cm left and 16 cm right of umbilicus. [d] Following Trial 6, subject rested 10 min. [e] Scored as "hit" because of apparent shielding of sensors in kidney areas.

TABLE V. Response to hf Beam by Subject Shielded with Aluminum Wire Loop: *Trial Series A*.[a] (Beam reached subject at his left side.)

Trial number	hfg	Dowsing signal	Score	Part of head shielded
1	*on*	yes	hit	no shield worn
2	*on*	yes	hit	scalp
3	*on*	no	hit[b]	forehead
4	*on*	yes	hit	nose
5	*off*	no	hit	nose
6[c]	*on*	no	hit[b]	forehead
7	*off*	no	hit	no shield worn
8	*off*	no	hit	scalp
9	*on*	yes	hit	scalp
10	*off*	no	hit	forehead
11	*on*	no	hit[b]	forehead
12	*off*	no	hit	nose

[a] Wire was 3.5 mm in diameter. [b] Scored as "hit" because of apparent shielding of sensor(s) in brain. [c] Following Trial 6, subject rested 10 min.

TABLE VI. Response to hf Beam by Subject Shielded with Aluminum Wire Loop: *Trial Series B*.[a] (Beam reached subject at his left side.)

Trial number	hfg	Dowsing signal	Score	Attitude of shield
1	*off*	no	hit	no shield worn
2	*on*	no	hit[b]	horizontal, circling head at pineal level
3	*on*	no	hit	vertical, saddling scalp forward of ears
4	*on*	yes	hit	no shield worn
5	*off*	no	hit	horizontal, circling head at pineal level
6[c]	*off*	no	hit	vertical, saddling scalp pineal of ears
7	*on*	no	hit[b]	horizontal, circling head at forehead level
8	*off*	no	hit	vertical, saddling scalp forward of ears
9	*on*	yes	hit	no shield worn
10	*on*	no	miss	vertical, passing over nose and scalp
11	*off*	no	hit	horizontal, circling head at pineal level
12	*off*	yes	miss	vertical, saddling scalp forward of ears

[a] Conditions same as in Table V. [b] Scored as "hit" because of apparent shielding of sensor(s) in brain. [c] Following Trial 6, subject rested 10 min.

at the third quarter of his body seen anteriorly, this flap intervening between kidney area and activated hfg. When the flap was worn on the side of the body away from the activated hfg, signal was observed (Table I). When a single flap was worn somewhat above the waistline and successively moved around the body for separate trials, signal weakened markedly as the flap reached a position 5 cm right or left of the spinal column (Table II).

However, when two flaps 10 to 15 cm apart were worn somewhat above the waist, no signal at all could be obtained provided the flaps were located on the back and

symmetrically right and left of the spinal column, and with the subject turned so that the beam arrived from the rear. (Table IV). Under the same conditions, but with the beam arriving from front or sides, signal was observed.

With a crown worn around the head and successively moved from scalp level to chin level, the beam evoked signal except when the crown rested on the ears. When a loop of aluminum wire (described under EXPERIMENTAL) was substituted for the crown and placed around the head 65 ± 5 mm above the ear entrances, no signal was observed as the subject walked perpendicularly to hf beam (Tables V, VI). Nor was signal observed when the loop was positioned to extend upward from jaw level, across the top of the head, and proceed downward to jaw level, passing about 13 mm in front of both ear entrances, again with subject walking perpendicularly to the beam. On the other hand, with a vertical loop placed to pass from chin over nose, between the eyes, and over the top of the head to the cerebellum vicinity, signal was not observed provided the subject turned so that the beam arrived from his front or back.[11]*

DISCUSSION AND CONCLUSIONS

Using belt and flap locations as coordinates, one may conclude from the data that a magnetic sensor exists in the area of each kidney, perhaps more accurately in the adrenal gland regions.

The crown (and looped wire) experiments apparently indicated a magnetic sensor in the brain and established a coordinate system; the intersection points seem to localize the region of the pineal gland as the possible seat of this sensor. A signature processor has been proposed to account for transduction of magnetic stimulus to physical response (dowsing signal—i.e., L-rod movement) and, further, to explain apparent discrimination among magnetic signatures when a dowser responds, say, to the signature for water. Although hard evidence is lacking, the numerous measurements and observations during the present experiments suggest that possibly this processor is associated with the sensory mechanism in the pineal region.

On the basis of the data, a model can be proposed for the mechanism of so-called field-dowsing. When the dowser walks over an area of dowsing interest, sensors in the kidney area and perhaps in the brain are stimulated by magnetic field gradient changes of a given pattern (signature). What the dowser perceives are these differentials, implying the existence of at least two sensors in a gradiometric mode.[10] The stimuli are transmitted to a processor in the brain. The dowser, by gift or training, can discriminate among signatures; that is, his processor can be programmed to react to a specific signature only—e.g., the signature for water, for ores, for electromagnetic

* Indication of head-shielding effect was noted in 1969, when Kopp reported that a Swiss soldier-dowser was unable to develop signal when he donned the military steel helmet.

fields, etc.[13] Magnetometric studies have shown that signatures of underground water seepage or flow, for example, are wider than the sharply peaked signatures of electric power lines, telephone wires, or water mains.[14,15] All signatures, of course, are superimposed on the ubiquitous geomagnetic field. But if the perceived signature concurs with that delineated by the processor program, the brain commands the arms to twist.

The brain reaction also triggers increased bloodflow through the finger capillaries, thus increasing skin moisture and decreasing the ohmic skin resistance.[16] These responses are commonly observed along with the muscular activities of the arm that characterize the dowsing signal. As for dowsing instruments such as rods, pendulums, and the like, they are merely parametric amplifiers that provide visualization of the relaxing or tensing of certain muscles of the arm and associated minor movements of the hand. Actually, an ohmmeter measuring change of skin resistance can be used as a dowsing instrument; so can a plethysmograph to measure increase of bloodflow in the fingers.

Primarily at issue here, however, is not how, or even if, dowsing practitioners achieve the successes claimed for them. The goals of the experimentation were to support the hypothesis that magnetic sensors exist in the human body and to localize those sensors with some accuracy. Clearly the data do support the hypothesis and to a degree do localize the sensors.

Assuming that those sensors indeed reside in the adrenal and pineal areas, dowsing techniques in conjunction with artificial magnetic or electromagnetic fields could perhaps be used as medical diagnostic tools. A mechanical engineer and amateur dowser of Sidney, Australia, at age 18 had had his right kidney (but not the adrenal gland) removed because of severe injury; at age 57 he still dowses successfully.[11] However, a Swiss dowser lost his ability to dowse after his right kidney and adrenal gland had been removed.[11] Dowsers have complained of decreased sensitivity after contracting what they called "kidney trouble."[11] It would be interesting to collect data on the dowsing sensitivities of individuals and correlate those data with particulars of kidney disorders, if present. This could lead to still more precise localization of the sensors in man. Similar studies could be undertaken with persons whose ailments could be connected with pathology involving the pineal gland.

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MAN IN A GAS OF TACHYON MAGNETOLECTRIC DIPOLES—A NEW HYPOTHESIS. PART I. A SUMMARY OF SOME REAL BUT UNEXPLAINED BIOCOSMIC PHENOMENA

FREEMAN W. COPE
Biochemistry Laboratory, Naval Air Development Center, Warminster, Pennsylvania 18974

• *Various biocosmic phenomena have been reported which are probably real but are not explained by present scientific theories. These include (A) diurnal cycles in antigen-antibody reactions at magnetic electrodes, (B) solar radiation of unknown type detectable by sensitive persons, absorbed by metal plates, conducted down metal wires, and trapped in bilayer metal boxes, (C) colored clouds (auras) around magnets and man visible to sensitive persons, and (D) grid lines parallel to lines of latitude and longitude detectable by sensitive persons (dowsers) but not by electromagnetic instruments. Reliable reports of these phenomena are summarized here in preparation for the development of a physical theory to explain them, which is presented in two accompanying papers.*

I. INTRODUCTION

Various biological-cosmic phenomena have been reported which are probably real but are not explained by present theories of physics, chemistry, biology, or psychology. The phenomena I shall list have been described by observers who are probably reliable. Data contaminated by mysticism or the like have been omitted. Trained scientists have mostly ignored these phenomena because they did not fit easily into conventional patterns of scientific thought. It will be shown in this series of three papers that these phenomena do fit into the framework of classical and modern physics provided one new hypothesis is added, a hypothesis to the effect that man lives within a gas of electromagnetic (EH) dipoles. In other words, it is proposed that in the universe around us exist a large number of particles each of which is both an electric and a magnetic dipole. Each EH-dipole is assumed capable of dissociation under certain conditions into a pair of separate EH-monopoles (i.e., two monopoles each with both electric and magnetic charge). Some of the EH-monopoles are tachyons; i.e., they have velocities faster than light. Because the EH-dipole dissociates into EH-monopoles only in ultrastrong magnetic fields, the monopoles will usually not be observable experimentally. The behavior of the EH-dipoles and the conditions for dissociation are deduced from classical electromagnetic theory. The tachyon properties are guessed at from the surmises of the possible and probable behavior of tachyons (the existence of which has not yet been demonstrated

experimentally) by the group of physicists working in this advanced branch of theoretical physics beyond relativity.

The present paper, first in a series of three, will summarize some biocosmic phenomena, the observations of which the present author believes probably reliable. The scientific qualifications and methods of investigation relevant to judgments regarding the reliability of the data are presented in the second paper of the series, as are various physical concepts necessary for the construction and evaluation of a theory to explain them. The theory itself is developed in the third paper, followed by discussion of its predictions and correlations with observed phenomena.

The biocosmic phenomena at issue in this paper include the following: (A) Diurnal cycles in antigen-antibody reactions at magnetic electrodes, apparently due to magnetic radiation of an unknown type from the sun. (B) Rays from the sun of unknown type which can be detected by sick (and by some sensitive normal) humans, absorbed by metal plates, and conducted by metal wires. (C) Rays from the sun of unknown type which affect human health and can be trapped in bilayer metal boxes. (D) Colored clouds (auras) around magnets and man which can be seen by sick people (and by a few sensitive normals) and can be made visible to normals by chemical sensitizers. (E) Grid lines parallel to lines of latitude and longitude, which are observable by certain persons (dowsers) but not by conventional magnetic or electric detectors.

II. DESCRIPTIONS OF REAL BUT UNEXPLAINED BIOCOSMIC PHENOMENA

(A) *Antigen-Antibody Reactions at Magnetic Electrodes Influenced by Solar Radiation*

Rothen[1-9] of the Rockefeller University developed a new method of unusually high sensitivity for the detection of antigen-antibody reactions by measuring their effects on electric currents across surfaces of metal electrodes. When he extended this study to use *magnetized* electrodes made of ferromagnetic metals (usually nickel), a set of unexpected phenomena was observed. Rothen[2] found that the magnitude of the antigen-antibody reaction at the electrode surface was markedly influenced by whether and in which direction the electrode was magnetized. He observed further[3-9] (as documented by a large number of experiments) that the magnetic effect was influenced in a major and consistent way by the time of day or night at which the experiment was conducted (diurnal cycles). The diurnal cycles persisted even when the experimental apparatus was kept in a dark place where no light from the sun could possibly penetrate. Rothen[4-9] then conducted numerous experiments in which his electrodes were shielded by various thicknesses of various metals. From the complex pattern of results, he concluded that the observed data could only be understood from the hypothesis that two unknown types of cosmic radiation interacted with his magnetic electrode systems. One type, he deduced, must come from the sun and a second type must come from all sides at all times. The two types of radiation were different in their susceptibility to absorption by different kinds of metal shields.

(B) *Solar Rays Detectable by Man, Absorbable by Metal Plates, and Conductable by Wires*

Von Reichenbach[10] concluded that certain sensitive people, most of them seriously ill (e.g., with advanced tuberculosis) but also a few completely healthy, could detect some type of radiation which originated in the sun but was different from light and from any other electromagnetic phenomenon known to him. Von Reichenbach himself, and most other non-sick people whom he tested, could not detect this radiation. In a large number of intelligently designed and well-controlled experiments using the sensitive human subjects as detectors, he studied the physical properties of this new radiation. He obtained the surprising results that this radiation could be absorbed by metal plates and conducted along metal wires. Conduction was not virtually instantaneous as in the case of an electric current but was slow (extending over minutes), as if by diffusion. The new radiation could not be detected directly by any physical measuring instrument known to von Reichenbach.

(C) *Solar Rays Which Can Be Trapped in a Bilayer Metal Box and Which Affect Human Health*

Wilhelm Reich,[11] using man and animals as detectors, reported the existence of a new type of radiation. This radiation, he found, could be trapped in metal boxes covered with cellulose (e.g., with wood), and it could be collected in metal funnels and conducted down metal tubes. The effects of the radiation were observed in places where sunlight could not penetrate. However, it apparently came from the sun because its intensity followed a diurnal cycle, increasing gradually from sunrise, peaking at noon, and decreasing gradually toward sunset. It was markedly decreased on cloudy days, presumably indicating that it was absorbed or reflected by water in clouds. This radiation made itself known by producing a feeling of well-being or of tension in many human subjects and by suppression of growth of cancer in man and animals.

(D) *Colored Clouds (Auras) Around Magnets and Persons*

Von Reichenbach[10] reported that some sick people and a few healthy people could see light around bar magnets. Von Reichenbach himself, and most healthy people tested by him, could not see these auras. The magnet auras were perceived to be of various colors and showed a difference of color and/or intensity of light between the north and south poles of the magnet. Similar auras were observed by Kilner.[12] Images of magnet light were transmitted through glass lenses according to the same rules as ordinary visible light.[10] The magnet light was weakly detectable by photography, according to von Reichenbach.[10] Kilner[12] and Bagnall[13] reported extensive observations of auras around persons. The auras appeared as "clouds"

of various colors. They could not be seen in a room that was completely dark; a small amount of illumination was needed to achieve the effect. The ability of these investigators to see the human auras was enhanced (1) by experience, (2) by looking through solutions of certain colored dyes, and (3) by staring immediately prior to the observation at light reaching the eyes through solutions of certain dyes. The color and morphology of the human auras were altered in a regular manner by the age, sex, and state of health or disease of the subjects. The aura of man was altered by electric charge on the subject as well as by proximity to magnets,[12] and disappeared after death. Kilner[12] and Bagnall[13] concluded that human auras were consistently detectable by careful observers who used appropriate experimental techniques. These investigators were not able to identify the cause of the auras in terms of any physical or chemical process known to them.

(E) *Dowser Grid Lines Around the Earth*

The dowser (the person who can find underground water with a forked stick or the like) is apparently able to perceive something that electromagnetic instruments cannot. Harvalik[14,15] reports that dowsers can perceive a grid of lines "like walls" which presumably cover the earth and are approximately parallel to the lines of latitude and longitude, and extend out from the surface of the earth along radii from the earth's center. These lines have been detected in various places in North America and Europe by various dowsers.[14,15] In Virginia, the north-south lines are approximately 25 cm wide and separated by 2 m, and the east-west lines are 15 cm wide and separated by 1.7 m.[14,15] Over a 3-year period of observation in Virginia, the lines did not move; i.e., they remained in constant position relative to the surface of the earth. When searched for by several dowsers, the lines were found in the same position with a variation of only 5 to 10 cm.[14,15] The lines detected by the dowsers could not be detected by a fluxgate magnetometer (sensitivity $= 10^{-5}$ G), by a cesium magnetometer (sensitivity $= 10^{-10}$ G), by an electric field strength meter, or by an air ion detector.[15] It was observed, however, in the twilight, that flying insects gathered in little swarms at crossing points in the grid lattice.[15] Therefore it seems that insects, like human dowsers, possess a biological detector for these grid lines, which have not been detected by any man-made instrument for measuring magnetic or electric fields.

III. SUMMARY OF THE FOREGOING REAL BUT UNEXPLAINED BIOCOSMIC PHENOMENA

For convenience, the observations just described can be grouped into three categories:

1. There exists a new type of radiation (not light) from the sun which reacts with antigen-antibody systems at magnetic electrodes, and with sensitive people (usually sick people), and is absorbed by metal plates, collected by metal funnels, accumulated in cellulose-metal bilayer boxes, and conducted along metal wires and metal tubes. This radiation behaves differently from any known electromagnetic field or wave and differs from any known particle in nuclear or cosmic radiation.

2. A cloud of something exists around bar magnets and people, which can be seen by certain sensitive people, and can be made visible to more people with the aid of certain dyes.

3. Grid lines approximately one to two meters apart over the surface of the earth exist, and are consistently detectable by sensitive persons (dowsers) and probably by insects. These lines are approximately parallel to the lines of latitude and longitude and remain stationary for at least several years. These lines are not detectable by magnetic field measuring instruments of high sensitivity, by electric field meters, or by air ion meters.

IV. CONCLUSION

There exist on our earth several cosmic phenomena which affect man and other biological systems but which are not measurable by present electromagnetic instruments and are explained neither by present classical or modern physics nor by any present chemical, biological, or psychological knowledge. It is the purpose of the next two papers of this series to provide the missing explanation.

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MAN IN A GAS OF TACHYON MAGNETOELECTRIC DIPOLES—A NEW HYPOTHESIS. PART II. INTRODUCTION TO THE THEORY

FREEMAN W. COPE
Biochemistry Laboratory, Naval Air Development Center, Warminster, Pennsylvania 18974

• *In the preceding paper of this series, some unexplained biocosmic observations were summarized. In the present paper, these observations are shown probably to be reliable. In addition, it is pointed out that there is no reason to distrust results of experiments which use man as a detector provided appropriate precautions of design and conduct of the experiments were taken. In the theory developed in the third paper in this series to explain the biocosmic phenomena summarized in the first paper, mostly classical electromagnetic concepts are used. However, a few concepts from advanced theoretical physics are also used; namely, tachyons, magnetic monopoles, and magnetic dipoles. These concepts are described briefly in this paper.*

I. THE PROBLEM

Good observations exist of a set of biocosmic phenomena as described in the first paper of this series.[1] No scientifically plausible explanation of these phenomena now exists.

II. PURPOSE

I aim to explain the described phenomena within the framework of known physical laws, with a minimum of new hypotheses, with a minimum of extrapolation into frontier areas of physics where uncertainties exist.

No mysticism is to be used.

I aim to stay as close to experiment as possible, and as close to easily visualizable physical concepts as possible.

III. THE APPROACH

I aim to use classical electromagnetic concepts as much as possible (electromagnetic fields and particles conforming to Maxwell theory). However, concepts

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TABLE OF CONTENTS

Previous Records: There are no earlier reports in the literature of this species occurring in West Virginia. There is an unpublished record (3) of *travisi* from the Cranberry River.

C. variipennis (Coquillett)

New Records from this Study: Coll. 108 (11 males, 6 females); Coll. 110 (2 males, 9 females). *Previous Records:* not known from West Virginia prior to the present study.

Summary

In addition to the 7 species covered in this paper, the following *Culicoides* had been previously collected in West Virginia: *C. bickleyi* Wirth and Hubert: Cranberry Glades (4). *C biguttatus* (Coquillett): Cranberry Glades (5). *C. dickei* Jones: Cranberry Glades (3). *C. loisae* Jamnback: Cranberry River (2). *C. mulrennani* Beck: Cranberry Glades (3). *C. nanus* Root and Hoffman: no location given (6). *C. obsoletus* (Meigen): Cranberry Glades (7). *C. paraensis* (Goeldi): Capon Springs (3). *C. piliferus* Root and Hoffman: Cranberry Glades (5). *C. sanguisuga* (Coquillett): Allegheny Mtns., Cranberry Glades, Lost River State Park (7); Monroe Co. (8). *C. snowi* Wirth and Jones: Lost River State Park (4). There are now 18 *Culicoides* spp. known from West Virginia.

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Z. V. Harvalik

U. S. Army Advanced Materiel Concepts Agency
Alexandria, Virginia 22314
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A Biophysical Magnetometer-Gradiometer*

Abstract—The human body seems to be able to detect minute magnetic field gradient changes. If an interaction of a magnetic field with the human body occurs, a slight twist of the forearms is observed and can be amplified by a simple mechanical device, the dowsing rod. The sensitivity of man to magnetic fields can be determined by exposing subjects to magnetic fields produced by electric currents (AC or DC) of varying intensities passing through damp ground. The lower the intensity of the current, thus of the magnetic field, required to produce reaction of the subject the greater is his sensitivity to magnetic field changes. A reaction is observed only when the negative electrode is at the left (heart) side of the subject. About 80% of the subjects tested showed a pronounced sensitivity toward magnetic field changes. Some applications of this biophysical phenomenon are discussed.

S. W. Tromp (1) and Y. Rocard (2) in their books seem to consider dowsing a phenomenon worthwhile for scientific consideration and scrutiny and are inclined to explain dowsing as a manifestation of interactions of many energy forms externally applied to the human body, with the major contribution being magnetic ones. From the literature (1, 2, 3) one can see that there are many people who have the ability to manipulate the dowsing rods successfully.

According to the author's experience almost 80% of individuals exposed to the manipulation of dowsing rods of the type reported by Budgett in 1935 (4), showed some ability to obtain signals, while less than 20% were successful when the forked twig was used. This experience suggested use of the dowsing rods. The dowsing rods mentioned consist of 2 L-shaped rods or wires 2–4 mm in diameter, the longer part being about 60–80 cm long, while the shorter one is 15 cm in length. The shorter part of the L-shaped rod is handheld so that the longer part can swing freely around a horizontal axis (being the shorter part). To reduce friction the shorter part of the dowsing rods is put into a tubing as a bearing. The dowser holds in each hand one of the L-shaped rods and adjusts them by twisting the arm so that they are parallel in the horizontal plane. Appropriate twist of the arms to parallel alignments of the rods can produce convergence or divergence of the rods to indicate a signal. The use of 2 rods is preferable to one rod only because convergence or divergence is easier to detect. An increase of the depression angle of the longer part of the L-shaped rods in the vertical plane reduces the reaction sensitivity of the dowser. A depression angle of $1^\circ - 5^\circ$ renders good sensitivity and also satisfactory stability of the rods when they converge or diverge indicating a signal.

The material of the L-shaped rods and of the bearing tube does not influence the performance of the dowser. The dowsing rods indicate the twist of the arms only. The twist of the arms is the result of an interaction of external energy forms (magnetic field changes) with the human body. All experiments were done, and data reported below were obtained, by using these rods.

A dowser will be successful, the more he is able to detach himself emotionally from the dowsing activity or from any other "exciting" thoughts. Signals are observed when the dowser moves by walking, by being driven in a car, or by sitting in a moving airplane. He also is able to observe a signal if he is exposed to a moving Alnico magnet or an electromagnet, or by a stationary electromagnet while the energizing current is increased. This author noted however, that the convergence (or divergence) of the rods indicating the signal does not occur while the magnetic field is decreasing. However, when he is walking or making the leg motion of walking, the null adjustment (to parallel rods) is obtained when the magnetic field fades. A fairly sensitive dowser is able to react to magnetic field changes of 0.1 gamma/second or less.

Experiments performed by the author have shown that when a direct current passes through the ground a dowsing signal is obtained only when the negative pole is on the left (heart) side of the dowser. It would be interesting to use a subject having a *situs inversus* as a dowser in this experiment. Would this subject react only if the negative electrode is on his right side? If he walks parallel to the direction of the current (toward or away from the negative pole) he obtains a signal. This observation suggests a directivity of the phenomenon, thus excluding Rocard's (2) explanation of dowsing by proton resonance of some constituents of the human body. When alternating current is used, no directionality is observed.

Using the intensity of a direct current passing

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through the ground between 2 electrodes separated at least 10 meters from each other, this author was able to determine quantitatively the sensitivity of a dowser toward a magnetic disturbance. Most of the subjects tested (60%) showed an incipient signal when the current was about 35–50 mA. A good dowser shows a signal at 10–20 mA while only a very few react to currents of 0.5–10 mA. By appropriate training the sensitivity can be increased (from 40 mA to 10 mA). Assuming that the location of the interaction of the human body with the magnetic field is in the vicinity of the thorax (approximately 1.5 meters above the ground) the magnetic field intensity above the current path is then approximately 0.1 gamma at 20 mA current intensity. Thus traversing the magnetic field produced by the current of 20 mA with a walking speed of 2 m/sec a field change of 0.03 gamma in the vicinity of the field apex (maximum) would cause a signal from a dowser of average skill and aptitude (15%). Skillful dowsers of above average aptitudes (4%) react to 2 mA currents (0.003 gamma) and exceptional ones (1%) to 0.5 mA or less (0.0007 gamma).

Brain waves (5) and heart currents (6) of man were observed and measured with high-sensitivity magnetometers and recorders. This author attempted successfully to detect these currents (and thus the associated magnetic fields) utilizing the dowsing rods. The subject to be tested was placed in varying distances, back to back, to the dowser and was asked to think of something very exciting. He also was asked to start thinking not immediately after this instruction was given, but after a time of his choosing. The dowser announced the reaction to the subject. Thus, the subject was able to determine the instant at which the dowser reacted to his thoughts. The closest distance of the subject to the dowser was 2 feet. Some persons were able to produce reaction of the dowser even at 16 to 20 feet.

The strongest magnetic emissions from the subject were produced by sex-related "exciting" thoughts and thoughts of fear. Positioning of the subject (back to back, left or right side to back, front to back of dowser) relative to the dowser did not show any significant change in the signal intensity displayed by the dowser. All 28 subjects (19 males and 9 females) did cause reactions of the dowser although some were weaker than others. Subjects with high blood pressure seemed to produce stronger magnetic fields than those of normal or low blood pressure.

It should be mentioned that dowsing reactions could be observed by the dowser when he himself is thinking of "exciting" things while dowsing. This observation of the author suggests the necessity of psychological detachment of the dowser to avoid spurious reactions. It also could explain why some dowsers are not too successful when they demonstrate their skills in presence of an audience.

The above described experiments suggest strongly that man possesses the ability to sense weak magnetic field gradient changes which are indicated by skillful manipulation of dowsing rods. Thus, the dowser can determine the location of a magnetic disturbance, and in some cases perhaps the depth or height of the location of the origin of the disturbance. This magnetic interpretation could explain why the dowser is able to locate flowing water (unpaired moving ions), buried objects, including rocks, cavities (caves, tunnels) tree and vine root systems, culverts, overhead wires, and magnetic fields emanating from persons, especially when they are excited.

The dowser probably cannot determine the causes of the magnetic disturbance (buried metals, ores, rocks, flowing water, cavities, people). He only is able to observe a magnetic disturbance. Since the dowser reacts to magnetic field gradient changes only, the absolute magnitude of the ambient magnetic field has no influence on the performance of the dowser and on the appearance of a dowsing signal. This fact may facilitate the search for the biophysical principles upon which the dowsing mechanism is based.

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Russell L. Leonard, Jr.[†] and Kenneth A. Blick

Department of Psychology, University of Richmond Richmond, Virginia 23173

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A Reevaluation of the Length-Difficulty Relationship

Abstract—Task difficulty was assessed when task length was varied and when task length was confounded by changes in the nature of the task. A trend analysis revealed that task difficulty increased at a disproportionately faster rate when length and nature of the task were confounded, but only linearly when task length was varied.

Introduction

Early experimenters who investigated the relationship between task length and task difficulty generally found that time increased at a rate which was disproportionately faster than the increase in the amount of material. Lyon (1) studied the time taken to learn various numbers of syllables and prose words, and he found a positively accelerated relationship between time to learn and number to learn. For example, a *S* requiring 2.25 minutes to learn 50 prose words took almost four times that long to learn 100 words. Scott and Henninger (2) found the same relation to hold for learning of the finger maze as the number of choice points was increased.

However, the positively accelerated function found in the earlier studies might have been due to some qualitative changes in different aspects of the nature of the task as the length was increased. The present experiment was designed to analyze the effect of task length alone, holding task nature constant. It was hypothesized that if the only variable was task length, then the relation between difficulty and length would be essentially linear.

Method

Forty introductory psychology students at the University of Richmond were systematically divided into two groups so that each contained twelve females and eight males. Each group was then broken down into an ascending and a descending group, each of which contained six females and four males.

The apparatus was a card-sort apparatus containing three rows of five boxes each (Lafayette Instrument Co.). The numbers 1 to 15 were stamped on three removable strips which could be shifted around from top, middle, or bottom as desired. The cards consisted of 3 × 2 inch paperboard, with numbers printed in black on one side.

One group was designated as the Task-Length Group (TL) and the other as the Length Group (L). The *Ss* were handed decks of cards of varying sizes, with the numbers face down. At the *E*'s signal, *Ss* were instructed to turn the cards over one at a time and to sort them into the appropriately numbered boxes. The *Ss* were further instructed that should they accidentally drop a card into the wrong box or onto the floor, they were not to attempt to retrieve it, but to continue working as rapidly as possible. Each group received seven trials either starting with 70 cards and ending with 10 in the descending condition, or starting with 10 and ending with 70 in the ascending condition.

Group TL (ascending) started with two sets of five cards bearing the same number (i.e., one set consisted of five 1's, another of five 4's, etc.), the numbers being selected in a random manner from 1 to 15 (except number 9). The deck was increased on each trial by the addition of two more sets, selected at random, until on trial seven, 14 sets, or 70 cards were used. The procedure for Group TL allowed for the manipulation of both task length (number of cards) and task nature (the addition of different numbers). The descending group received the same treatment, except that they started with 14 sets and on each subsequent trial two sets were removed. Two minutes were allowed between trials, and the *Ss* were instructed to face away from the apparatus during the intertrial interval. The counter-balancing procedure of ascending and descending series equally distributed the effect of learning and/or fatigue over all seven points within each group.

Group L received essentially the same treatment as Group TL, except that on trial one, ascending, the *S* had 10 cards consisting of two each of five different numbers (i.e., two 1's, two 3's, two 14's, two 5's, two 8's, etc.). On each subsequent trial the *S* used two more cards on each number so that he used the same number of cards on each trial as did Group TL. A table of random numbers was used to assure that all of the 14 numbers were used at least once during the experiment. The *Ss* were timed to the nearest second on each trial, and the pooled data for the ascending and descending treatments for each group were used in analyzing the results.

[†] Present address: Department of Psychology, Ohio State University, Columbus, Ohio.