Pendulum: the Psi Connection

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the puzzle is this: science has identified four basic forces which govern the behaviour of the minute particles that make up the universe, and most physicists agree that no new force is needed to complete what is already a deeply satisfying picture; yet none of the forces seems fully capable of solving the basic mystery of how the dowser gets his information.

Only in the last decade or so have come the first few encouraging pointers. The main one of these, which will occur again and again in the next two chapters, is the gradual recognition by scientists that somewhere within our bodies we are capable of sensing and processing minute signals about changes in our environment. It seems that all of us can, quite unconsciously, detect tiny differences in such things as barometric pressure, electrical activity, temperature, magnetic fields, radio beams – a whole host of shifting influences that, because they are invisible and so small, we have long ignored.

What dowsers of old instinctively recognized as their much-derided 'ray of attraction' has become tantalizingly close to being measured.

5 The Attraction of Magnetism

The search for dowsing's 'fundamental ray', pursued from the turn of the century onwards with sporadic and mostly amateurish vigour, was almost completely ignored by reputable scientists. They had a number of apparently sensible reasons why. Amid the emerging picture of physics during the 1930s, no such ray could be seen to exist, or even need to exist. At the time, it also seemed ludicrous to suggest that humans could perceive and interpret something as intangible as, say, a radio beam – scientific receivers and amplifiers were needed for this purpose. But mostly, it was a question of measurement. Dowsers were claiming a special sensitivity and affinity to this so-called ray – but how on earth could this be quantified? With such normal senses as sight and hearing (though not reliably touch, taste or smell), this could be done; with the dowsing sensation, it could not.

Nevertheless a few dowsers, and even fewer scientists, were undeterred. The obvious existence of the dowsing reaction, however caused, was sufficiently strange and enticing for them to continue to research. Cecil Maby and Bedford Franklin produced their immensely complicated theories about the interaction of various forms of energetic waves which would combine to form a signal which the dowser recognized.[1] They also proved some physiological side-effects of the dowsing reaction, such as decreased skin resistivity. But this was a long way from showing that dowsers had a definite and measurable skill compared with other people.

One way through came from steady improvements in the design of magnetometers, devices which measure the strength of the magnetic field created by magnets. The Dutch geologist Professor Solco Tromp, in a 534-page book called *Psychical Physics*,[2] reporting on experiments that took place in 1946–7, showed that blindfolded dowsers were able to detect a sudden, but small change in the gradient of such a field. But it was not until the

arrival of the proton magnetometer during the 1950s that sufficiently sensitive and repeatable experiments became possible. Since then, two scientists have come up with findings that, because they are so surprising, are still greeted in many academic circles with incredulity. First, in 1963, Yves Rocard, Professor of Physics at the École Normale in Paris, the leading French college of teachers, was able to suggest in his book *Le Signal du Sourcier*[3] that the magnetic field gradient changes identified by dowsers were not just small, but almost inconceivably tiny. And now Dr Zaboj Harvalik, a scientific adviser to the US Defense Department, and for twenty-five years Professor of Physics at Arkansas University, has shown in a series of experiments from 1968 to the present day that even Rocard grossly underestimated the capacity of nearly all of us, and good dowsers in particular, to sense minute changes in our environment.

For a non-scientist, it is perhaps as difficult to grasp the concept of magnetism as it is to comprehend the infinitesimal amounts of energy being talked about. However, it is crucially important to make the effort, for in both Rocard's and Harvalik's findings may lie a vital key to understanding how dowsing works.

Magnetism is one of the two components of electromagnetism, which is the second strongest of the four fundamental forces known to physicists (the others being nuclear, radio-active, and gravitational). Yet we cannot, in normal circumstances, feel it as we can feel, for instance, gravity (which we notice every time we take a step or lift an arm) or other environmental factors such as temperature, pressure, atmosphere and light. On the contrary, the static magnetic field has hardly any apparent effect on the human body; put your finger inside a child's horseshoe magnet and you sense nothing. Yet the effect is there (as you could tell at once if the same finger wore a metal ring), and the fact is that we all live perpetually under the influence of a giant magnet – the earth itself.

For, although nobody has agreed on the details of how it happens, the earth produces a magnetic field, probably created by the flow of molten metals at the earth's core. Compared to a child's magnet, it is very weak – but it is remarkably constant, even if unnoticeable in day-to-day life. The standard unit of

measurement for static magnetic field strength is a gauss. The strength of the field created by the whole earth varies somewhat from the equator to the poles, but averages about half a gauss. A child's magnet would be, typically, about one thousand gauss. So, remembering how difficult it is to feel the force of a child's magnet, consider that it will be two thousand times more difficult for you to recognize the power of the earth's field. Nevertheless, we are all living under the influence of this half gauss of magnetic field strength all the time (*Diagram I*).

Most of the time, we are so well adjusted and accustomed to this influence that we simply don't notice it. However, work by a handful of scientists suggests that when there is a sudden change in the field strength, we unconsciously sense this.[4] The approach of magnetic storms causes the earth's field to reduce suddenly, and studies in America, Denmark, Switzerland and Israel have shown that this has a marked effect on human behaviour. Psychiatric admissions to hospitals increase; there is a strong correlation with certain pathological states and suicide. What is more, people are known to be able to anticipate the arrival of such unpleasant winds as the mistral in the Mediterranean, or the khamsin in the Middle East, two or three days in advance, and this is because they are reacting to the associated magnetic change. Animals can detect the imminence of an eathquake by sensing the magnetic changes built up by pressure in the underground rocks. Experimentally, people have been placed for ten days in a laboratory from which the influence of the earth's magnetic field was artificially removed (to simulate conditions on other planets). At the end of the period, they were unable to distinguish whether an electric light bulb was flickering or constant.

Dowsing sensitivity

An electric storm, if it is a powerful one, decreases the earth's field by a factor of about 100, and one might predict that the human body would notice the difference. But these are, relatively, gross effects. What Yves Rocard reported about the sensitivity of dowsers was far more astonishing. His results suggested that they – and many ordinary people as well – could detect a change in the level of a magnetic field gradient of only three ten-

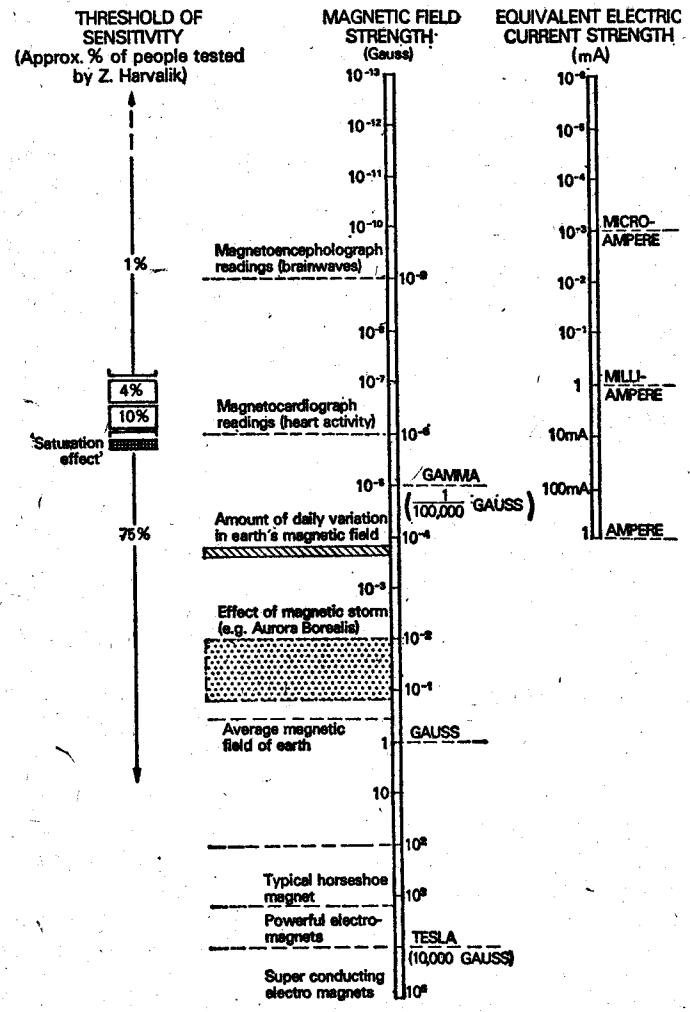


Diagram 1 **HUMAN SENSITIVITY TO MAGNETIC FIELD GRADIENT CHANGES**

thousandths of a gauss. This tiny amount was measurable only by the latest magnetometers, and it was beyond any scientist's suspicion, let alone belief, that the human body and brain could accurately sense a variation as minute as this.

If it was true, it meant that these same dowsers could probably detect the tiny drift in the magnetic field of the earth each day, which the new equipment was now establishing as also being around thirty gammas (a gamma being one hundred-thousandth of a gauss). So incredible did the whole idea sound that scientists on the whole ignored the findings, or ascribed them to faulty laboratory work.

It was certainly true that some elements of Rocard's experimental methods could be criticized; also, that he had used only a very small number of experienced dowsers, compared with his untrained pupils. So what Zaboj Harvalik wanted to do in America was to try to repeat Rocard's results on a larger scale, and without the problem of temperamental equipment. As a Trustee of the American Society of Dowsers he had access to many volunteers, and the solution he came up with was both simple and effective. He decided to create a controllable weak magnetic field in his own garden.

First he used a magnetometer to survey the ground, to find an area relatively free from the magnetic anomalies caused by overhead power lines, buried cables, drains and so on. (In the light of his previous experience with dowsers, he was cautious enough to have a good dowser check the site; as a result, it was moved a few yards, and rechecked with the magnetometer.) Next, he drove two iron pipes, each three feet long and three-quarters of an inch in diameter, into the ground twenty metres apart. Finally, he connected these pipes to a DC electric power supply, one to the positive and one to the negative, arranged the cables so that they would not interfere, and switched on. As the power leaked through the slightly damp earth from one pipe to another, a weak magnetic field appeared around and above it.

Zaboj Harvalik says he used this method of soil conduction, instead of the copper wire coils of Rocard, because he knew that dowsers were sensitive to all manner of spurious signals from natural and man-made electromagnetic fields such as those from power lines, and radio or television transmissions. While these

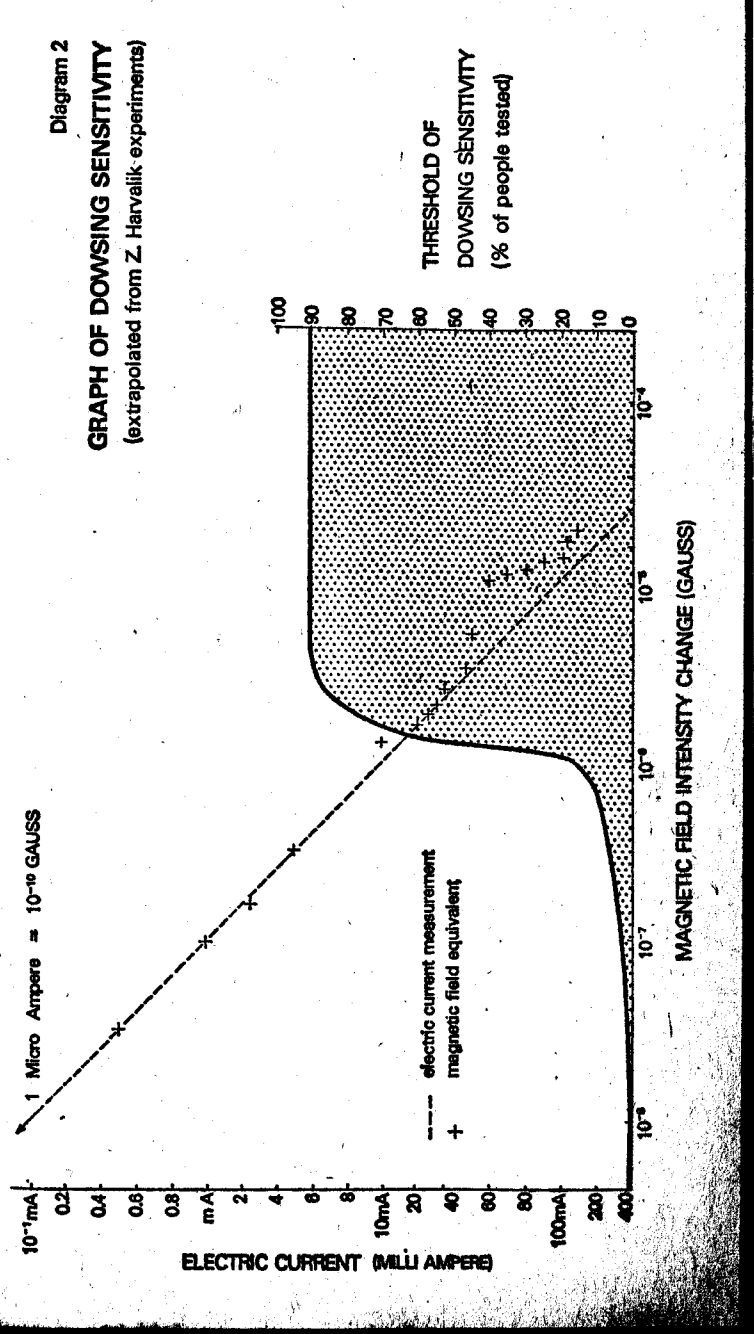
could affect the copper wire coils even when they were switched off, the soil in his garden minimized them to a level where they were no longer noticeable, and therefore could not interfere with the dowsing experiment.

By varying the voltage of the power supply, he could increase or decrease the strength of the field. A meter capable of measuring as little as one-millionth of an amp – the standard unit of electric current – monitored the amount it was going up or down. He used his magnetometer to correlate the change in levels of electric current to different strengths in the magnetic field. All that any volunteer had to do was to walk between the two electric poles with a dowsing instrument, and say from their dowsing reaction whether Harvalik, hidden out of sight, had switched the current on or off. Most people used angle rods, which swung outwards or inwards as they crossed the line between the pipes. Harvalik in turn was able to reduce the power progressively (or at random) until the dowser was unable to recognize the signal.[5]

A summary of his findings, using more than 200 people over three years, many of whom had not dowsed before, is shown in diagrams 1 and 2. In brief, not only did he confirm and extend Rocard's description of the sensitivity of dowsers, but he has also been able to show that the threshold lies beyond the best portable magnetometer yet made. His most sensitive subject, the German master dowser Wilhelm de Boer, was still identifying a weak signal at a micro-ampere (one-millionth of an amp, or 1 μA) and below. To most people, this is barely credible. In the conditions existing in Dr Harvalik's garden at the time, 1 μA= 10^{-10}G (0.0000000001 gauss). In plain language, de Boer recognized a change in the magnetic field gradient *one billion* times weaker than the earth's own weak field. When the results of the experiment were put to Dr Paul Fatt, head of the Department of Neurophysiology at University College, London, he said with an air of defeat: 'How does that man live on this earth?' For as we shall see, it has always been held theoretically impossible that such a tiny signal could be identified and singled out from the mass of background radiation that bombards us all the time.

But just as important as this exceptional result has been his

Diagram 2



finding that up to ninety per cent of all people can sense change of as little as half a gamma. This compares with around fifty per cent of those tested by Rocard in a much stronger magnetic field, and Harvalik ascribes the difference mainly to the use of angle rods instead of the traditional forked rod.

'More or less all of us can tune in, if we let ourselves,' he says. 'On the other hand, there comes a point in the graph, around half a gamma, when most of us stop registering the anomaly. After that, I think we have to leave it to the professionals. About five per cent of people can get to recognize a gradient change of one-millionth of the earth's magnetic field. So far I've only come across one man – de Boer – who can go a long way beyond that. His sensitivity is phenomenal, nothing less. It makes you feel he could achieve almost anything.'

So far, Harvalik's work is probably less appreciated even than Rocard's. In part, this is due to the obscurity or inaccessibility of his material – out of thirty-four papers which he published between 1970 and 1976, thirty were for the *American Dowser*, the journal of the American Society of Dowsers, which is neither highly regarded nor widely read in established scientific circles. Also, scientists who have taken the trouble to read his papers criticize them for not including enough data on which to check the statistical validity of his findings.

However, Harvalik himself is unworried (although quick to point out that all the raw data is kept carefully on file).

> The important thing was to get down on paper the work I was doing, and the way I was doing it. Anybody is now free to repeat my experiments, and I'm sure that their results will not be significantly different. However, after my experience with de Boer, I would say it is essential to have a 'double-blind' system for switching the current on and off. I have shown how to make a cheap randomizer that will perform this way, so that neither the operator nor the dowser knows the switch position until afterwards. It is now clear to me that many dowsers can pick up your thoughts, perhaps even your subconscious ones, and this can affect the results.

Fatigue effects

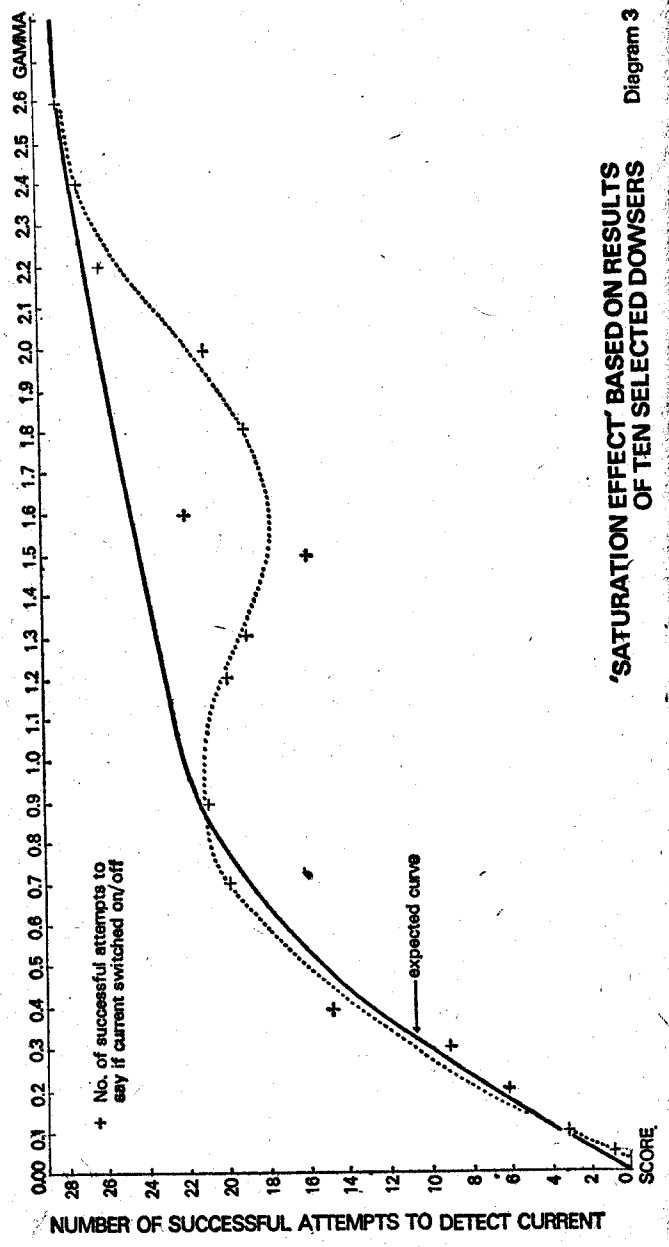
In fact, having established, to his own satisfaction, the general principle that we are all extremely sensitive, and some dowsers extraordinarily so, Zaboj Harvalik's interests have turned to other aspects of his experiments, which have turned up as by-products. Why, he wonders, is there a 'saturation effect' from about 1·2 to 2 gamma? The results show that in this narrow range, many dowsers become confused, and cannot recognize whether the current is switched on or off (*Diagram 3*).

Again, he has noted that fatigue sets in much faster than can be explained purely by the physical effort of walking several times backwards and forwards – results quickly become extremely unpredictable:

> If you move about holding dowsing rods for between quarter and half an hour, which is the length of time it takes to do a series of fifteen or twenty walks backwards and forwards across the magnetic field, there is bound to be a certain amount of physical tiredness – your muscles don't react quite so sensitively. But I also think that the monotony which so many dowsers have complained about in tests in other places, also plays a considerable part. Anyway, I insist nowadays that nobody has more than a dozen test runs in succession, even if they say they want to go on. We get much more consistent results by leaving off and resting for a while.

He has published a limited set of results to back up this belief. Testing four dowsers over the familiar artificial magnetic field in his garden, he found that they were correct 88 per cent of the time during the first five runs; 72 per cent in the second five runs; 40 per cent in the third. (Predictably, he found he could 'wake' them by pumping up the current in the fourth run.) One detail of the test was even more striking: during the first ten runs, not once did a dowser say the current was on, when it was in fact cut off – 100 per cent success; during the second ten runs they were wrong 90 per cent of the time – almost as if the dowsing reaction had gone into reverse.

Other curiosities that have come out of the experiments include the fact that Wilhelm de Boer could increase his sensi-



'SATURATION EFFECT' BASED ON RESULTS OF TEN SELECTED DOWSERS Diagram 3

tivity tenfold if he drank two glasses of water before he dowsed – and that after a good lunch his sensitivity dropped by a factor of 1000. On another occasion, a volunteer who had at first been unable to get a dowsing reaction, drank a large Bourbon and shortly afterwards was cheerfully and accurately saying whether the field was on or off at a level of less than half a gamma.

Trivialities apart (if that is what they are), the implications for dowsing of the over-all findings are highly important. They do nothing less than indicate a possible explanation for much of the mystery of site-dowsing – because although Harvalik's experiments were carried out in artificial conditions, it may be highly significant that magnetic field anomalies occur naturally in many of the areas in which dowsing has traditionally been successful. Underground water, for instance, as it flows along a channel, creates tiny amounts of DC electricity which would be recognizable as a magnetic disturbance on the surface of the ground; so would water seeping through porous rock, or a slowly-shifting table of water next to, for instance, a bed of clay.

Similarly ground disturbance creates magnetic anomalies. Archaeologists using proton magnetometers can detect the position of former ditches, walls, and so on, which leave a magnetic imprint at the surface of between half a gamma and 40 gammas – easily within the detective reach of a competent dowser. The tunnels, caves and mineshafts in North Vietnam (see p. 65) produced the same effect. So does buried treasure, electric cables, sewers, drains . . . in fact, a large proportion of the artefacts that dowsers are called upon to seek.

Searching for the sensors

But the problem immediately arises as to how the dowser distinguishes between one anomaly and another. Dr Harvalik looks for the answer in recent research which has shown that different artefacts throw up different three-dimensional 'signatures'. Like the difference between two people's handwriting, no two magnetic signatures are exactly the same – there is a broader magnetic pattern for underground water flow than for a buried cable, for instance. If we were able to perceive these signatures visually, they would look rather like individually shaped mountains, or molehills, sticking up from the otherwise flat country-

side. Just like seeing, the whole process might take place in a dowser unconsciously and almost instantaneously. To continue the analogy, we are all able to concentrate visually on one face in a room crowded with people, or to separate one conversation from another at a cocktail party in what sounds like an unintelligible cacophony when heard later in a tape recording. Similarly, a dowser might be able to sort out one magnetic signature from another.

But if this is so, Zaboj Harvalik knew that it was necessary to discover whether enough parts of the human body were acting as sensors to detect the minute differences of pattern, which are three-dimensional, being vertical, horizontal and perpendicular to the plane formed by the first two. As with two eyes, the dowsing centres had to be in separate parts of the body, so as to be able to perceive in perspective.

One riddle presented itself at the beginning of his tests – the mysterious fact that in a magnetic field produced by DC electricity, the dowsing reaction occurred only when the dowser's left side (heart side) was towards the pipe/electrode carrying the negative flow of current. In other words, the dowsers could detect the magnetic anomaly only one time in two; when they turned round and walked back to where they had started, the reaction disappeared. Harvalik puzzled about this, particularly as one set of results, when volunteers used the traditional forked twigs instead of L rods, seemed to contradict his findings. But with Wilhelm de Boer it was conclusively true.

In de Boer's case, the normal dowsing reaction is an upward flick of his forked wire rod. Before and during the tests, Harvalik deliberately refrained from telling de Boer about the polarized signal suppression. Nevertheless, it occurred invariably. Harvalik reported: 'With his heart side towards the negative electrode, and with the current switched on, he showed a reaction 100 per cent of the time; facing the other direction, there was 100 per cent signal suppression. The only odd effect was that occasionally, when he had his heart side towards the positive electrode, he had an abnormal dowsing reaction – his rod flipped downwards instead of upwards.'

By accident, Harva'ik was able to identify the part of the body where this suppression takes place. He noticed that of all the

dowsers tested with angle rods over the artificial magnetic field, one man was able to dowse with equal accuracy in both directions. In other words, this dowser alone did not experience signal suppression. Discussing the matter with him, Harvalik discovered that he had once suffered a severe multiple fracture in his upper left arm, which had been mended with the aid of an eleven-inch-long stainless steel pin in the marrow cavity. Harvalik therefore simulated this condition by attaching metal rods to the left arms of other dowsers, including de Boer. As soon as he did so, the signal suppression disappeared for them also.

'I have no explanation for this at present,' says Harvalik. 'But it was such an oddity that it made me continue in my search for other parts of the body that were related to sensing magnetic or other signals.'

Already, in 1967 and 1968, he had made an experimental study using a highly effective magnetic shielding material known as the Co-Netic AA Perfection Annealed Sheet. Although his paper on the subject does not give the transmission characteristics of the sheet, he says that the attenuation was considerable. He took a piece about a foot wide, and wrapped it twice round himself loosely so that it formed a cylindrical barrel that could be moved up and down his body. Then, blindfolded, he moved in and out of the magnetic dowsing zone, with the barrel covering various parts of his head and torso; an observer noted when his angle rods indicated a dowsing reaction. As a result, he came to the general conclusion that when the area between the seventh and twelfth rib was shielded – roughly between the navel and the sternum – the ability to dowse weakened or disappeared. This was consistent with much dowsing literature, and a certain amount of scientific research in Switzerland, which suggested that the solar plexus might be one of the dowsing sensors in man.

Later, with Wilhelm de Boer, he was able to refine his experimental methods by watching him dowse through a carefully-oriented high-frequency electromagnetic beam (usually radiating at 58·55 megahertz with a strength of one watt), switched on and off by the randomizer. Instead of the crude approximation given by his earlier barrel shield, he was now able to form a shield with an aluminium belt only two inches wide, or two-inch square metal strips, to narrow down the area where the magnetic

radiations were being perceived. After many tests, with de Boer walking across the beam at various angles, Harvalik was able to report:

> Two magnetic sensors exist in the kidney region, perhaps more accurately in the area of the renal gland of each kidney. This region does not include the solar plexus, although it is fairly close.
>
> I know of two cases, at least, which seem to confirm this. A good Australian dowser, an engineer who lives in Sydney, had his right kidney removed when he was eighteen years old, but not his renal gland, and it has left him unaffected. But a Swiss dowser has completely lost his ability after having his right kidney and renal gland removed. Some dowsers have complained to me of decreasing dowsing sensitivity when they have had what they call 'kidney trouble'. I am now certain in my own mind that this is one of the key sensory areas in the human body.

The other area that most dowsers feel to be important in receiving signals is the head (or brain). Robert Leftwich, for instance, can demonstrate this by leaning forward at an angle over an underground stream or pipe; when his forehead is directly above the centre, his rod flips upwards. Swiss research includes the case of a soldier-dowser who lost his dowsing ability when wearing his Army steel helmet. So Zaboj Harvalik, operating the same methods of shielding, but this time using 3·5 mm aluminium wire as well as the two-inch belt, attempted to pinpoint the area precisely. Tests seem to show that it was somewhere along a line taken through the brain just above the ears and behind the temples.

It is too early to be certain just how accurately Zaboj Harvalik has identified these two sensory areas for dowsers, or if there may be more. He himself has drawn attention to one confusing, and possibly contradictory piece of evidence, which is that if both areas are shielded simultaneously, as opposed to just one or the other, the dowsing reaction not only reappears, but increases in strength. But what excites Harvalik is that if he is right about there being two or more centres, this provides a theoretical

model of how a dowser can sense, in three dimensions, the difference between one kind of magnetic field and another. He has summarized his thoughts on this a number of times:

> If three-dimensional perception of dowsing patterns is possible – that is to say, if a dowser can recognize and react to vertical as well as horizontal components of the magnetic field – then this would enable him to discriminate between the 'signatures' of the various disturbances. He could programme himself (or dowse) for specific features such as water, minerals, and so on, all of which have different signatures. A subterranean cavity shows a different magnetic field pattern from a buried power line or water flow.
>
> The process of dowsing would then be described as a search to identify a particular magnetic signature. As soon as the search was successful the brain would give the order for the arms to twist, the blood flow would increase through the finger capillaries, the skin moisture would increase, and all the other minor physiological changes that make up the dowsing reaction would take place.

Put succinctly like that, it sounds as neat an answer to the problem of dowsing – at least, of site-dowsing – as could be found. But alas, it isn't – as Dr Harvalik, after yet more experiments, is the first to agree. Static magnetism may well play a role, and a very important one, in the mystery of how we sense the unknown. But it forms only a small portion of the ocean of other unseen forces that influence our lives; and of these, electromagnetism is another one which, scientists are now discovering, has an unsuspectedly large part.

The electromagnetic spectrum

The importance of electromagnetic waves to dowsing is, quite simply, that somewhere in their infinite spectrum there may be a frequency, or a series of frequencies, which can carry enough information for the dowser to be able to perceive what he is looking for. Here may lie the dowser's 'fundamental ray', by which he interprets information radiating from deep beneath the earth or far beyond the horizon in somewhat the same way as a

radio receiver is able to. Of course, this is not a new theory; but in the last fifteen years, scientific experiments with sophisticated and highly sensitive equipment have shown that, as with static magnetism, human beings may be far more receptive and responsive to electromagnetic waves than anyone had believed possible.

Again, in order to understand the theoretical possibilities, it is necessary for a non-scientist to make the effort to visualize broadly just what electromagnetism is: in essence, waves travelling at the speed of light that carry information about disturbances in the fundamental particles of the universe. All bodies at above absolute zero temperature (0°K) in our known physical universe emit electromagnetic radiation. The theories surrounding this were first proposed by James Clerk Maxwell in the middle of the nineteenth century; their true nature was discovered in 1888 by Heinrich Hertz, whose name has been immortalized to describe one of the most important properties of electromagnetic waves – the fact that they oscillate (pulse, vibrate) at different frequencies. This oscillation takes place in inverse proportion to the length of the wave. Thus a wave one metre long oscillates more than one hundred million times a second (10^8 hertz); a wave one hundred kilometres long oscillates at a rate of three thousand times a second (3 kilohertz) (*Diagram 4*).

This range is literally infinite. At the low end of the scale, at around one hertz (that is to say, one oscillation per second, when the electromagnetic wave is so slow that it is virtually indistinguishable from static magnetic or static electric fields), the length of the wave equals approximately 50 times the radius of the earth. Astronomers think they have discovered waves that last for forty seconds, which would give each wave a length of seven million miles. At the other end of the scale are the cosmic and gamma rays that bombard the earth from outer space, their wavelength so short that a million side by side could pass through the eye of a needle.

In between come the familiar frequencies that we have learned to use. Going upwards through the scale are the radio waves, long, medium, and short; the microwaves, now used for cookers and communications, and shortly to be incorporated in a host of

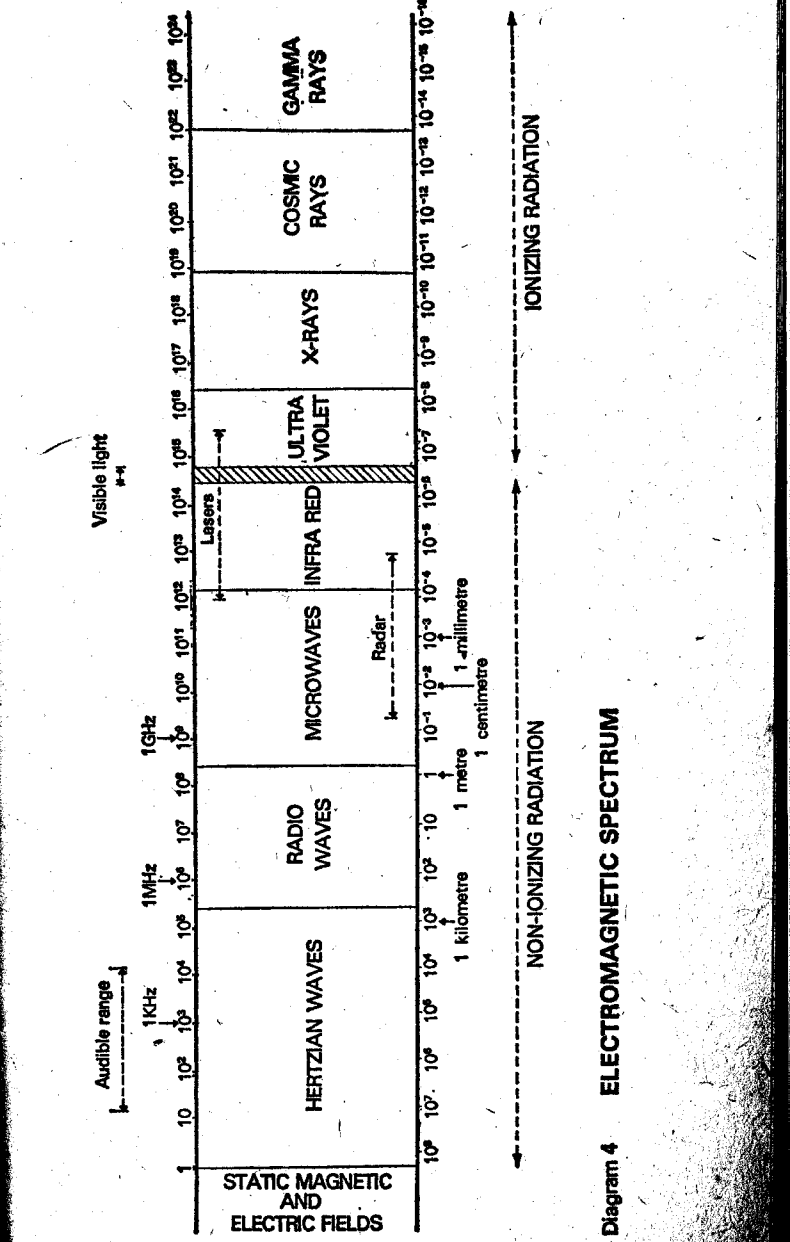


Diagram 4 ELECTROMAGNETIC SPECTRUM

new technological devices for the home; then infra-red rays applied in physiotherapy; next the relatively narrow band of electromagnetic waves that make up visible light; and finally ultra-violet and X-rays.

Biological systems – including man – are known to generate low-energy electromagnetic fields covering a large portion of this spectrum. Since all other bodies also emit electromagnetic radiation, it would be simple and natural to assume that just as we can see in the visible spectrum and hear in the audible range, there might be a sympathetic area elsewhere that would give a dowser (or perhaps all of us) the means to interpret unseen information. Somewhere in the spectrum, perhaps in many places, would lie a frequency that was transmitting information to us just like a radio beam, used in telecommunications, while we used some hitherto unrecognized part of our body or brain to decode and interpret it. But unfortunately, there are profound theoretical objections to this, of which perhaps the most basic is that at the high end of the spectrum, radiations that penetrate the body can be lethal; while at the low end of the spectrum they do not have enough energy to upset the natural stabilizing processes in the body – they simply go unnoticed.

In spite of this, a few scientists, running the risk of ridicule and ostracism, have continued to search for a way of resolving the many difficulties and paradoxes. Their work has been exceptionally arduous, not just because many scientists are hostile or hidebound in this area of research (and therefore won't co-operate), but also because orthodox theory presents genuinely formidable, almost insurmountable, obstacles in the way of a rational attempt to establish just what wavelength a dowser, or a mind-reader, might use.

For a start, the so-called 'ionizing' radiations – those in the frequency spectrum above visible light, can almost certainly be eliminated. They are just too dangerous, and a combination of the nature of our environment, and the protective skin on our body, prevents most of them penetrating us. For instance gamma rays, the shortest wavelengths of all, were we not shielded by the layer of ozone in the atmosphere, would simply annihilate the tissue of all living things (which is why there has been so much concern about damage to the ozone layer by supersonic aircraft,

or the action of aerosols).

Cosmic rays are almost as powerfully harmful in the way they cause genetic change and damage, but most of the time are kept out by the earth's magnetic field. It is known that from time to time in the earth's history this field reverses polarity, so that the north pole becomes the south pole, and vice versa. During the time in which this process takes place, there is for a while no magnetic shield, and this has been linked with genetic mutation and the extinction of various species of animals; some scientists even suggest that such reversals can be directly related to the emergence of man himself.[6]

The harmful effect of X-rays has been known since soon after their discovery in 1895. There were early signs in paint factories and mines where radiation in these frequencies was high, that people began to suffer from hair loss, burns, skin ulcers and cancers. The development of the nuclear bomb and then nuclear power stations has led to a colossal research effort into this area of the electromagnetic spectrum (in just one year recently, the US Atomic Energy Commission experimented on 783,615 rats and 111,084 mice). Yet people are still arguing about what is the 'safe' level of exposure; X-ray photographs in hospitals are now used as little as possible, and it may even be that prolonged viewing of colour television, which emits small quantities of X-rays, is enough to trigger off effects in the human body. Ultra-violet light, most of which is, like other ionizing rays, filtered out by ozone, carries similar hazards – sunburn, a link with skin cancer – though to a lesser degree.

So it is among the non-ionizing radiations, below the wavelengths of visible light, that the search for the dowser's 'information carrier' has been concentrated. But here too. orthodox scientific thinking would say that the range of frequencies is just as impossibly unsuitable, if for different reasons. The generally accepted view is that the only effect of these non-ionizing radiations on the human body is thermal – when directed with sufficient energy at people, they heat the molecules of the body and cause damage. The simplest example is the fact that you get burned by infra-red waves if you stand too near a fire. There is an eye disease known as glass blowers' cataract, caused by years of being exposed to the infra-red rays in furnaces that

make glass; the skin and the cooling effect of the blood has protected the bodies of people suffering from the disease, but not the eyes, which have little blood and a poor cooling mechanism.

Similarly in the range of frequencies called microwaves, the effects on humans have always been thought to be purely thermal. As they have a greater capacity to penetrate tissue (the longer the wavelength, the more this becomes true), they have been used for 'deep heat' treatment of some illnesses; some frequencies will relieve soreness or sprained muscles, others have destroyed tonsils without the need for surgery, or have scarred parts of the brain in the treatment of Parkinson's disease. This ability to penetrate also led to the development of microwave ovens for cooking.

At lower frequencies than this – in the spectrum of radio waves, and below – scientists have been almost unanimous that, apart from the way in which we are able to hear sound waves vibrating in the air within a band of hertzian frequencies, they had no effect on the human body whatsoever, and that they were therefore irrelevant to the mechanism of dowsing, telepathy, or anything else. It was certainly true, as shown by the radio waves, that they could be used to transmit information. But it was obvious to everybody that broadcasting involved far more expenditure of energy than the tiny levels which the human body generates. Also, to make broadcasting work, you have to have an aerial and an electrical conducting system – and there was no way, according to orthodox theory, that the body could conceivably function in this way. So, since it was held to be theoretically impossible for low frequencies of radiation to be detected biologically, scientific research in this area was minimal.

But as we shall see, a number of strange effects, at first apparently unrelated, began to disturb this general view. Gradually, observations were collected to suggest that we all, instead of being inanimate sponges for all this radiation, are on the contrary finely balanced mechanisms somehow capable of reacting to almost every wavelength that reaches us. This steady accumulation of evidence has mostly been ignored or resisted by mainstream science, an attitude which was criticized at a high level in 1971 by Paul E. Tyler, of the US Navy Department's Bureau of

Medicine and Surgery, when he introduced a conference on the subject to the New York Academy of Sciences:

> It has been said that present physical laws do not account for any non-thermal effects, and unless new laws are discovered, there can be no possible effects of electromagnetic radiation on biological systems. This statement is slightly contrary to good science. In general, our present laws have evolved after many trials and errors. Many so-called laws have been altered or discarded after scientific observations revealed that the concept or law would no longer account for new scientific facts. A classic example of this was the belief held for centuries that the earth was the centre of the universe. It was only after many observations were made which did not fit this theory that a re-evaluation occurred and the concept was discarded.[7]

A similar re-evaluation is taking place right now. Revolutionary and upsetting though it may be to the accepted concepts, there is already overwhelming evidence that low frequency electromagnetic fields and weak static magnetic fields can affect all life. According to James B. Beal, of the World Institute in New York: 'As a product of the Cosmos, we are all tuned in.' And with this increasing knowledge comes the hope among some scientists that it will at last be able to encompass the nature of the dowser's fundamental ray.

Magnetoreception

Electricity, even when it wasn't understood, has long been put to medical use. The Roman, Anthero, said to be a freedman of the Emperor Tiberius, accidentally discovered that stepping on a live torpedo fish alleviated gout. Later, Dioscorides, who was a surgeon in Nero's army, and a famous herbalist of his time, used the discharges of electric fish to treat gout, migraine, and other illnesses. The Italian physicist Luigi Galvani wrote on 'animal electricity' in 1791, speculating on the electrical nature of life processes, and it has always been popularly assumed that 'rays' from electricity might be harmful. In 1891, when electric lights were installed in the White House, they were at first not placed in

the rooms used most often by the President, because they were thought to be too dangerous. However, in spite of this early guesswork, almost no research was carried out until the invention of powerful electromagnets in the 1930s began to make it possible. Even then it was largely ignored, overshadowed by work in pure biology, and then later by the pressing need to discover more about the obviously harmful effects of nuclear radiation, which was so immediately important that nearly all available funds were devoted to it.

Nevertheless, a number of very odd occurrences, none of them attributable to thermal origins, were noted from time to time. There was the remarkable 'phosphene effect', discovered in 1898. This happens to most people when a bar magnet emitting electromagnetic waves at 30–60 hertz, and with a strength of 200 gauss upwards, is held against their temple; they believe they can see light, even if they are in a blacked-out room. Then, it was found that infra-red radiation at levels too low to give a sensation of warmth, could cause tiredness and headaches. When broadcasting was invented, it was found that some people could hear radio signals through the fillings in their teeth, which acted as amplifiers. But even stranger, many people who live near a strong radar beam can perceive it as a noise, generally described as 'buzzing like bees', and this happens both with deaf and normal individuals. Mental hospitals have patients who find the noise intolerable, for ear-plugs will not suppress it. Aurora displays have been heard by some people. So, too, have meteorites, usually in a form described as a buzzing or hissing. Since meteors travel faster than sound, through the upper atmosphere at levels where the air is too thin to transmit normal sound waves, these people must have been picking up an electromagnetic frequency.

Evidence of unsuspected sensitivity also accumulated from the animal kingdom. The electric fish *Gymnarchus niloticus* reacts to a change of magnetic field so weak that it is the equivalent to the disturbances caused by an electric light bulb at 1500 yards distance.[8] Birds and bees are thought to use the earth's magnetic field in homing and navigation – an experiment in which tiny magnets placed with the north and south poles pointing the wrong way round, were attached to pigeons so disorienting them that

they were unable to find their way.[9] The British scientist Dr G. V. Robins has recounted how at the site of an ancient megalithic tomb at Pentre Ifan in Wales, constructed in such a way as to create a magnetic field anomaly, a normally docile cat became hysterical when walking under the main capstone.

Clues such as these have helped towards the growing conclusion that all creatures are in some way affected by a variety of frequencies, and it is in Russia where most of the scientific research has taken place. For more than twenty years there has been a huge effort in dozens of universities and institutes, and their experiments, tens of thousands in total, have been summarized in *Electromagnetic Fields and Life* by Professor Alexandr S. Presman,[10] of the Department of Biophysics in the Faculty of Biology at Moscow University ('biophysics' being a new word coined by him and his assistants to summarize the interaction between the physical forces that surround us all the time, and the normal working of our bodies).

This book, published in an English translation in 1970, is required reading in any modern bibliography on the subject. But even so, its findings are the subject of much caution and disbelief by Western scientists, including John Taylor, Professor of Mathematics at King's College in the University of London (and probably best known for his popular scientific book *Black Holes*). Professor Taylor, a friendly and readily-accessible man in his forties, is one of the few internationally-renowned scientists in the Western world who finds dowsing a subject worthy of serious research, and his own experiments (referred to on pages 152 and 226) are meticulously prepared and recorded. He thinks that generally far too many of the Russian experiments are not backed up by good statistical controls, and that in Presman's reports much of the evidence of, for instance, sickness, was obtained by subjective techniques such as interviews. Putting the US point of view, Paul Tyler has said: 'Soviet literature and standards have created a controversy in this country for several reasons: lack of personal contact with research personnel, difficulty in translating, and different basic philosophies on how research is presented in the open literature. The criticism has been that Soviet literature did not contain adequate details to permit the replication of the experiments. Although this is a

valid criticism, our past publishing record is certainly not better.'

In spite of these caveats, the book was a milestone. Frank A. Brown Jr, Professor of Biology at Northwestern University, Evanston, Illinois, whose own work on circadian rhythms (see pages 137–8) is closely connected, introduced the translation with words showing that he, personally, was satisfied: 'The present convincing evidence is that living systems are steadily buffeted and stressed by the noisy fluctuations in the natural electromagnetic fields of their environment . . . organisms behave as specialized and very highly sensitive receptive systems for diverse parameters – strengths, frequencies, vector directions – of fields of the order of strength as the ambient natural ones.'

Again and again Professor Presman hammers home his point (although here, too, he is widely criticized for being both sweeping and vague). 'Organisms of the most diverse kinds – from unicellular organisms to man – are sensitive to . . . energy tens of orders [!] less than the theoretically estimated effective level.' 'Cumulative biological effects produced by repeated exposure to electromagnetic fields well below the effective threshold for a single exposure have also been observed.' 'Changes in tissues and organs are produced . . . in the absence of any significant thermal effect.' 'A very important feature of the biological effects is that they are often produced by fields of extremely low intensities.' 'Abundant experimental evidence directly confirming the role of environmental electromagnetic fields in life has been amassed in recent years.'

The experimental evidence quoted in his book suggests that there is virtually no organ or mechanism in the body which is not sometimes affected. Work on the brain, for instance, showed that structural changes took place in the brain cells of rabbits, cats, rats and guinea pigs when they were exposed to bursts of electromagnetic waves at a variety of frequencies. The affected areas included the crucial 'glia' cells that help conduct nerve impulses and are also possibly memory cells. Work on higher animals – monkeys – showed that their pulse rate, heart activity and central nervous system could be altered by strong constant magnetic fields; so were the embryos of frogs. A weak radiation at 2800 hertz caused the degeneration of a rat's testicles. In weak

static magnetic fields, birds and fish became more alert and energetic.

So numerous and varied were the responses of all kinds of animals and humans to the experimental conditions that examples of this kind could be quoted from almost every one of the book's 275 pages. But perhaps the most extraordinary general finding is that often the effect on the nervous system is the exact reverse of what one might predict – Presman found time and again that weak fields had a greater effect than strong fields, and that over all the physiological changes were 'independent of electromagnetic intensity'. This was noticeably the case in a lengthy experiment with dogs, when there were significant changes in their conditioned reflex to salivate at a given signal.

Another paradox was the powerful evidence that exposure to low levels of radiation on repeated occasions had a cumulative effect, whereas the body seems to be able to adapt quickly to repeated 'doses' of strong fields. He speculated that each of these short bursts of weak electromagnetic energy had worked like a trigger within the body, setting off a chain reaction much stronger than the original impulse.

The other strange general finding is that the effects are often contradictory and irrational. With his dogs, for instance, those with so-called 'strong' personalities salivated faster when they had been exposed to radiation; those classified as 'nervous' salivated more slowly. Depending on the type of electromagnetic field applied, the rate of growth of mustard seeds was inhibited or increased. In fact, Presman's results are so all-embracing that it is too early for anyone to be able to make them the basis of any detailed hypothesis. What he has succeeded in demonstrating is that electromagnetic radiation at minute levels can have an effect on human life in many ways, for better or worse. It is a mark of how seriously this area of research is taken in Russia that their safety standards impose a level of microwave radiation strength on humans 1000 times less than that permitted in the USA.

Indeed, research in North America has only recently begun to catch up – but now it is doing so, it is confirming Presman's broad picture, and as the evidence grows, it becomes steadily less

surprising that a dowser can, for instance, find true north, or identify the direction from which a radio beam is coming. Not only are these experimental results deeply fascinating, and perhaps revolutionary in their impact on the biological sciences, but through their complex analysis of the way in which the body reacts to minute levels of outside influences may come an understanding of the dowsing mechanism itself.

6 Rhythms of the Universe

Professor Frank A. Brown Jr, the biologist who introduced Presman's book to the Western public, is perhaps foremost among the handful of US scientists who have made pioneering discoveries about the way in which life reacts to minute levels of outside influences. Long convinced that unseen energies were playing a more important part in the behaviour of living things than anyone would recognize, he has performed since the 1950s an elaborate and careful series of tests which seem to prove that even under constant conditions of light, temperature, humidity and barometric pressure, all organisms have an internal biological clock and/or biological compass which enables them to maintain their regular rhythmic life patterns.[1]

The best-known example in man is jet-lag – the way in which we suffer if we are forced to change our normal pattern of waking and sleeping by moving quickly round the hemisphere. But as well as the solar day of twenty-four hours with which we must keep in tune, Frank Brown has discovered many more natural cycles that animals and plants live by: the sidereal day (the period of rotation of the earth relative to the stars) of 23·95 hours; the lunar tidal period of 12·4 hours and the lunar day of 24·8 hours; the lunar month of 29·53 days; and the solar year of 365·25 days. When he brought oysters, which feed and live according to a tidal cycle, from the coast of New England to his laboratories in Evanston, near Chicago, he found that after about a fortnight they were opening and closing according to the local phase of the moon. In spite of being kept in tanks of water too small for there to be a gross effect of tidal currents, they had somehow behaved like jet-plane travellers and adjusted themselves to their natural lunar rhythm.

If this was the first time it had been demonstrated that the passage of the moon could, by itself, affect a living creature, his work with potatoes was even more remarkable. These have been

Chapter 3

GENERAL READING

The most recent how-to-dowse books on either side of t Atlantic are Raymond C. Willey, *Modern Dowsing*, Esote Publications, Arizona 1976, which is comprehensive on t various techniques, and contains the hope that it will standar ize the terminology; and Tom Graves, *Dowsing: its Techniq and Applications*, Turnstone Press, London 1976, which is w illustrated and takes readers on a step-by-step progression. It highly recommended by Arthur Bailey, although newcomers the British Society of Dowsers are given F. A. Archdal *Elementary Radiesthesia* as an introduction. Many dowsers the traditional school have come to the subject via W. Trinder's *Dowsing*, London 1939.

1. Books by T. C. Lethbridge are a delight. Although, current thinking, his technique became complicated w pendulum lengths and 'rates', his enthusiasm for unortho archaeology, dowsing, ghosts, folk-lore and many other subje comes out idiosyncratically in *A Step in the Dark* and *Monkey's Tail*, Routledge and Kegan Paul, London 1967 a 1969, and *E.S.P. – Beyond Time and Distance*, Sidgwick a Jackson, London 1974.
2. Harvalik's statistics mentioned on page 116.

Chapter 4

1. If read cautiously, Ostrander and Schroeder's *PSI: Psyc Discoveries behind the Iron Curtain*, Sphere Books, London 19 remains the best general account. But most of the references virtually unobtainable.
2. Martin Ebon (ed.), *Psychic Discoveries by the Russia* Signet Books, New York 1971, is a collection of translat papers invaluable for understanding the background to psyc research in that country.
3. L. Vasiliev, *Experiments in Mental Suggestion*, Gally H Press, Hampshire 1962.
4. Bird's lecture in *AD*, August 1972.

5. John Sladek, *The New Apocrypha*, Hart-Davis MacGibbon, London 1973.
6. R. A. Foulkes, 'Dowsing Experiments', *Nature*, 229 (1971).
7. A. C. Williamson, *JBSD*, 118 (December 1962).
8. Leftwich's test was for Granada TV's *Margins of the Mind*, May 1968.
9. Maby and Franklin, *op. cit.*, note 4, chapter 1.
10. D. H. Rawcliffe, *Occult and Supernatural Phenomena*, Dover Publications, New York 1959, is a sceptical and comprehensive account, and together with Sladek, *op. cit.*, mentioned above, note 5 to chapter 4, and Christopher Evans, *Cults of Unreason*, Panther Books, London 1974, an excellent antidote to credulity.
11. D. M. Lewis, *JBSD*, 164 (June 1964).
12. E. S. Vogt and R. Hyman, *Water Witching, U.S.A.*, New York 1959. Although somewhat partial in dealing with individual cases, the book also contains two thorough larger-scale surveys in which dowsers as a whole fared no better than average.
13. Kenneth Roberts, *Henry Gross and His Dowsing Rod*, *The Seventh Sense*, and *Water Unlimited*, Doubleday, New York 1952, 1953 and 1957; as well as being highly readable, the three books give a vividly realistic picture of how dowsing is often spontaneous and unexpected, and therefore inexplicable even to the dowser himself.

Chapter 5

1. Maby and Franklin, *op. cit.*, note 4, chapter 1.
2. S. W. Tromp, *Psychical Physics*, Cleaver-Hulme, New York 1949. More of his research and summary in 'Review of the Possible Physiological Causes of Dowsing', *International Journal of Parapsychology*, X, 4 (1968).
3. Yves Rocard, *Le Signal du sourcier*, Dunod, Paris 1963. Not yet translated into English, but summary in M. F. Barnothy (see note 7 to chapter 6).
4. J. G. Llaurado *et al.* (ed.), *Biological and Clinical Effects of Low-Frequency Magnetic and Electric Fields* (report of a 1973 Colorado symposium), Charles Thomas, Illinois 1974. Detailed

material from this important symposium is mostly included
chapter 6, but the introductory lecture by James B. Beal, w
its references, has been drawn on here.

5. Harvalik's work has appeared almost without interrupt
in successive issues of *AD* from vol. 10, no. 4 (1970) to
present time. Mostly its presentation does not fulfil the requ
ments of the *Nature* reviewer (see page 103), but the intenti
are imaginative and determined.

6. Charles C. Conley, *Review of the Biological Effects of*
Low Magnetic Fields, NASA TN–D–5902 A–3415. Origina
part of research into the effects of such fields on astronaut
contains an excellent list of references, including those conce
ing the effect of magnetic reversals on genetic development.

7. The thermal/non-thermal arguments were summarized
Paul E. Tyler in an introductory paper in *Annals of the New Y*
Academy of Sciences, February 1975.

8. Gymnarchus niloticus . . . M. F. and J. M. Barnothy
note 7 to chapter 6).

9. Bird migration . . . W. T. Keeton, *Scientific Amer*
December 1974.

10. A. S. Presman, *Electromagnetic Fields and Life*, Ple
Press, New York 1970.

Chapter 6

GENERAL READING

N. Balfour Slonim (ed.), *Environmental Physiology*, C. V. M
Company, St Louis 1974, is the key modern text-book on
previously unsuspected effects of small changes in our surrou
ings, natural or artificial, and contains more than 1000 refere
as well as suggestions for further reading. Much of it is
going for a non-scientist, or even a non-specialist in the
ticular discipline. Some of the earlier research findings
popularized by Lyall Watson in *Supernature*, Hodder
Stoughton, London 1973.

1. Frank A. Brown Jr has written a definitive article in
vironmental Physiology (mentioned in General Reading abo
Otherwise see 'Living Clocks', *Science*, 130 (1959).

2. R. Wever, 'Effect of Electric Fields on Circadian Rhythm

Men', *Life Sciences and Space Research VIII*, North-Holland 1970.

3. Rat desynchronization . . . J. R. Lott and H. B. McCain, 'Some Effects of Continuous and Pulsating Electric Fields on Brain Wave Activity in Rats', *Int. Journal. Biometeor.* XVII, 3 (1973).

4. For Becker's summary of his work, see M. F. Barnothy, note 7 below. Psychiatric admissions and behaviour dealt with in Friedman, Becker and Blackman's papers in *Nature*, 200 (16 November 1963) and 205 (13 March 1965). Limb regeneration in Becker's 'Electromagnetic Forces and the Life Process,' *Technology Review*, vol. 75, no. 2 (December 1972).

5. Bone healing . . . L. S. Lavine and I. Lustrin, 'Electric Enhancement of Bone Healing', *Science*, 175, p. 1118 (1971).

6. Project Sanguine . . . J. G. Llaurado, *op. cit.*, note 4 to chapter 5.

7. M. F. Barnothy (ed.), *Biological Effects of Magnetic Fields*, vols. 1 and 2, Plenum Press, New York 1964 and 1969. Papers by Rocard (vol. 1) and Becker (vol. 2) are especially relevant. More recently, M. F. and J. M. Barnothy's 'Magnetobiology' in *Environmental Physiology* (mentioned in General Reading above) summarizes the whole field, giving 100 references. Interviewed, they have particularly recommended the work of D. E. Beischer with squirrel monkeys at Pensacola, Florida.

8. J. G. Llaurado, *op. cit.*, contains Bigu's summary of his work.

9. Harold S. Burr, *The Fields of Life*, Ballantine, New York 1972, according to Colin Wilson, 'could be just as important as the Origin of Species'.

10. M. A. Persinger, 'ELF Waves and ESP', *New Horizons*, vol. 1, no. 5 (January 1975).

11. Cole and Graf in J. G. Llaurado, *op. cit.*, note 4, chapter 5.

12. Bird flock synchrony . . . F. H. Heppner and J. D. Haffner in J. G. Llaurado, *op. cit.*

Chapter 7

1. Barry Fell, *America B.C.*, New York Times/Quadrangle Books, New York 1976, proposes an Iberian Celtic colonization *c.* 900 BC. My own account of North American megaliths and