



Electromagnetic radiation and health

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No-one knows the long-term effects of the invisible waves that now surround and penetrate us every day. They also appear in clinical therapeutics and diagnostics, however, and a GP, biomedical engineer, magnetic energy specialist, immunologist and consultant discuss the potential risks, benefits and clinical role of electromagnetic fields.

The GP academic: Prof Marc Cohen

Life has evolved bathed in a sea of electromagnetic radiation (EMR). This natural EMR may have both beneficial and harmful effects on living systems, depending on the frequency of the radiation and the dosimetry involved. Over the past century, natural 'background' EMR has been overtaken by manmade sources so that we are all currently exposed to artificial EMR of various frequencies from numerous sources, ranging from power lines, radio, television, monitors, microwave ovens and mobile phones. Currently there is

considerable controversy about the possible harmful effects of manmade EMR but perhaps less controversial is the suggestion that EMR may have beneficial effects and can be used as a basis for both effective diagnosis and therapy.

Health effects – there, but unclear

The study of the biological effects of EMR is an extremely complex and disputed one. Gross effects are usually attributed to EMR's thermal or ionising properties, however, it is now widely accepted that there may be many nonthermal effects of EMR. The biological effects of EMR may arise from many factors, including the electric- or magnetic-field components; energy content; frequency, coherence, resonance, or modulation of a fundamental frequency; the waveform;



amplitude or modulation of amplitude; the length of and timing of exposure; the area they are applied to; interference from other fields; presence of existing pathology (tumour-promoting rather than initiating effects); and the information content of the fields.^{1,2,3} However, while it is now clear that humans and other organisms are able to respond to fields as low as the earth's magnetic field, and that pineal melatonin production may be influenced by low-level EMR^{4,5}, it is unclear by which mechanisms low-level EMR affects humans.

Due to the difficulty of performing research in this area, most studies of EMR-induced pathology are based on epidemiological evidence. Epidemiological studies exist that demonstrate correlations between magnetic storm activity and psychiatric hospital admissions⁶⁻⁸, and between exposure to power-line radiation and the development of childhood leukaemia.^{9,10} However, while these studies are suggestive, they do not explain the causal pathways involved. Proponents of the harmful effects of low-level EMR suggest that EMR may act as a general stressor that would compromise already-susceptible individuals, as well as having long-term effects on otherwise healthy people.³ There are certainly many reported cases of sensitive individuals with so-called electromagnetic allergies, who may present with non-specific ailments or chronic fatigue, or illness occurring in places receiving extreme EMR exposure due to local geography and position of radio or microwave towers.¹¹

Safety in prudent exposure

While controversy remains over the potential for harmful effects of ambient EMR, the most sensible approach seems to be one of prudent avoidance and exposure minimisation, although this may be difficult where EMR-emitting devices have become part of the social fabric. There are also situations where

EMR exposure is necessary or desirable within certain limits, e.g. exposure to the sun for vitamin D production. There may be other 'beneficial' forms of EMR as suggested by the finding that there are naturally occurring extremely low-frequency (ELF) electromagnetic 'Schumann Resonances' produced by lightning that travel in the cavity between the ionosphere and the earth's surface. These have been found to have similar frequency components to the human EEG during meditation¹², and correspond to frequencies that preferentially propagate along acupuncture meridians.¹³ This suggests that internal homeostatic processes may be somehow 'tuned' to naturally occurring EMR.

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Therapeutic applications

The possibility of positive effects of EMR has led to the development of many devices that produce EMR for therapeutic purposes. This dates back at least to ancient Greece, where electric eels were used in the treatment of arthritis; and ancient China, where loadstone was used in healing. Today, the therapeutic uses of EMR range from the use of high-intensity fields (employed in ECT or defibrillation) to lesser fields (pacemakers or diathermy devices), and more subtle uses, such as in electro-acupuncture, Transcutaneous Electro-Neuro Stimulation (TENS), Transcranial Magnetic Stimulation (TMS), magnetic stimulation for bone healing, low-level laser therapy (LLLT), and Pulsed Electro-

Magnetic Therapy (PEMT), which involves the application of EMR field to various parts of the body to assist in healing.

The most thoroughly researched therapeutic application for PEMT is in the treatment of bone healing. This application originated from the work of Bassett and Becker¹⁴, who described asymmetric voltage waveforms from mechanically deformed live bone. The mechanism by which this therapy works is thought to be through an acceleration of extracellular matrix synthesis¹⁵, however, this is not entirely understood. In addition to an established role for use in bone healing, there is evidence to support the use of PEMT in treating a diverse range of conditions¹⁶, ranging from the healing of chronic venous ulcers¹⁷⁻¹⁹ to joint disease, such as rotator cuff tendonitis²⁰ and osteoarthritis²¹, as well as treating acute soft tissue injury, such as ankle sprain²², MS fatigue [see *JCM* 2004;1(1):66] and sports injuries.²³

There are a number of Australian companies producing and/or marketing PEMT equipment. These devices generally employ different waveforms and frequencies to induce small voltages in the body and are marketed to promote general well-being and tissue repair, as well as to treat pain and other conditions. To date, however, there have been few rigorous clinical trials using these devices, and confirmation of their efficacy requires further research.

Diagnostic applications

While the therapeutic use of EMR is ancient, its diagnostic application is relatively recent, beginning circa 1900 with the discovery of X-rays and the use of the galvanometer to detect the electrical activity of the heart, and progressing towards increasingly sophisticated and subtle uses. Current diagnostic techniques involve either subjecting the body to an energy source and detecting



the output, such as in conventional X-ray or MRI scanning; the detection of the body's own internal electrical activity, such as in the ECG, EEG, EMG, electro-oculogram, electro-gastrogram; or detecting other electrical properties of the body, such as the galvanic skin response (GSR) or impedance such as used in impedance plethysmography and body composition studies. Other diagnostic instruments that work on more subtle levels involve detecting the magnetic fields produced by the body to produce the magneto-cardiogram (MCG) or the magneto-encephalogram (MEG).

While many diagnostic applications of EMR have become standard medical procedures, there are less conventional applications falling under the heading of 'bio-energetic medicine'. For example, electrical measurements may be used to detect acupuncture points, which can be defined as points of low electrical resistance.²⁴⁻²⁸ Furthermore, the electrical properties of acupuncture points may be used to assess health status, as they have been shown to alter during pathological processes. This has led to the development of electrodermal screening devices that provide information about the electrical conductivity of various acupuncture points. These instruments, which are based on Russian and German research, purport to determine a person's energetic balance and draw correlations between the electrical conductivity of various acupuncture points and specific organ function. While the ability of electrodermal screening to detect food or other allergies has been severely criticised²⁹ and is not supported by evidence³⁰, there have been a number of small clinical studies suggesting that it may distinguish a range of pathological conditions, including GIT abnormalities³¹, lung cancer³² musculoskeletal pain³³, cardiovascular disease³⁴, diabetes³⁵ and hypertension.³⁶ Further research is required, however, to confirm the use

of electrodermal measures in clinical practice and much of this research may be performed in Australia, with the recent listing of Medec Ltd on the Australian stock exchange and a commitment to invest \$2 million on research in this area.

Bio-energetic medicine

It is often suggested that research into bio-energetic medicine will provide a new understanding of health and disease. It appears that the foundation for this increased understanding is currently being laid, with the recent publication of scholarly texts outlining the scientific basis of energy medicine^{38,39}, a set of definitions and research guidelines for energy medicine research³⁷, and the announcement that RMIT University is planning to launch a new short course on electrotherapeutics and diagnostics in energy medicine later in 2004. Certainly a more complete understanding of health and disease must include a better understanding of the electromagnetic nature of the body and this may provide the basis for 21st century medicine.

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Electromagnetic fields (EMF) have been considered very controversial over the past 35 years, especially in the lay media that is obviously unaware of the hundreds of scientific studies and thousands of papers on the subject. EMF cover an enormous spectrum, from sunlight to X-rays, radio, TV, electric currents, motors, computers, MRI and other medical equipment, household appliances, doorbells, telecommunications, phones, mobile cell-phones and towers, right down to every living cell in our body, as well as those in animals and plant life. There are extremely high frequency EMF in the potentially dangerous range, such as gamma rays, which are 10^{24} Hz (nuclear radiation), to ultraviolet (UV) at 10^{16} Hz; visible light around 10^{14} Hz between violet

(wavelength 390 nanometres and red (wavelength 770 nm); infra-red (heat, 10^8 – 10^{14} Hz); microwaves from 10^{10} Hz (including microwave ovens); and mobile cell-phones that are typically 900–1900 MHz. Extremely low frequency (ELF), from 300 to 25 Hz, contrast with the ultra-low frequency (ULF) band as in the human body (predominantly 0.5–20 Hz), however, have not been found to be dangerous. Magnetic energy gently oscillates from the earth at 9.6–10.2 Hz with a density of 0.5 Gauss and, together with the Schumann Resonances between 7.6–8 Hz via the pineal gland, is now considered to be the single most important controlling factor on biological processes.¹

Potentially harmful EMF

One of the most dangerous forms of EMF is the out-of-sight power wiring in a wall cavity behind your head when sleeping, or that mains-powered bedside alarm clock, which can induce harmful electromagnetic fields into the body. This

is a continuous 50 Hz current that may over time cause cell damage. There are also low-level geopathic energies from the earth that can be disruptive. It is generally accepted that most of the very high frequencies and high power forms carry potential health risks, including some of the aforementioned sources. Ionising radiation, such as X-rays at 10^{20} Hz, has well-known risks. The waveform shape, and whether the signals are direct, alternating, pulsed or oscillating, are very important considerations. Importantly, there are both 'good' and 'bad' EMF.

There are hundreds of articles stating and debating the potentially harmful effects of EMF on our health, and the uncontrolled increase and plethora of EMF pollution is of grave concern.²

Beneficial EMF

To explain 'good' EMF, we need some basic 'back-to-school' physics. The normal cellular functions involve specific electromagnetic activity, including the DNA spin and intra- and intercellular communications. Whenever an electric current flows (electrons in movement), there is a magnetic flux around the current-carrying conductor. Conversely, when a magnet is moved or pulsed near a conductor, an electric current is induced in the conductor, which can be a wire or even conductive tissue or fluid in the body.³ This is called 'electromagnetic energy'. Over the years, many devices have been developed to provide electromagnetic energy to the body to assist in healing and pain relief.

One such method, known as the MERIT (Magnetic Energy Resonance Induction Therapy)⁴, has proven beneficial by assisting in a return to health and in maintaining wellness. This is not just another method of treating disease or sickness, but helps the body differentiate between good and sick cells, and promotes the production of 'good' healthy cells. Both the TGA and the FDA list products using the MERIT system.



Bodily effects

When the body is close to or within an area of the correct form of specifically pulsed oscillating magnetic energy, all the molecules in the cells are subjected to changing potentials, which assist the balance of ionic movement in and out of the cell walls. The sodium–potassium pump is stimulated, the cell uptake of nutrients and oxygen is enhanced — as is the Krebs cycle — and water, carbon dioxide and waste products are removed. SpO₂ (oxygen partial pressure in the tissue) is increased, which encourages improved health of each cell. The DNA spiral (and its magnetic spin) in each relatively healthy cell is tightened. However, damaged or faulty DNA spiral is unravelled at one specific frequency, and in this case cell mitosis is inhibited, meaning that replication of such unhealthy cells is not encouraged. By also stimulating the thymus gland to produce more T killer and T helper cells, the immune system can be improved.⁵

Treatment protocols

One of the safest and most effective methods of therapeutic treatment is to use appropriate magnetic energy combined with a sensible nutritional food intake, lifestyle and exercise changes and, in most cases, supplementation with vitamins, minerals and herbal or homeopathic medicines as supervised by a suitably qualified healthcare practitioner. This is not to deny the often-necessary medical attention for some serious conditions, nor to reduce the medical practitioner's role, but need to put more emphasis on returning to health and learning how to maintain wellness.

The correct form of magnetic energy, operating only from 0.5–18 Hz (which are within the predominant brain wave frequencies) has helped many otherwise 'impossible' cases back to health, and has amazed so many in different situations where conventional medicine could offer

no more. It works in a complementary way with conventional medicine to assist in proper absorption, relieve many side effects, expedite recovery and improve the general well being of the individual.

The MERIT system is well proven in sporting injuries around the world for more than 18 years. Double-blind, randomised, placebo-controlled clinical trials at Monash University and Medical Centre during 1998–9 showed the safety and efficacy of this treatment method.⁶ Electromagnetic therapy is non-invasive, and superior to electric forms of therapy as there is no contact necessary with the body, and no problems with skin burns or fatty tissue resistance.

Various forms of permanent or static magnets have been used since 850BC. These can offer some help in peripheral circulation and in relieving minor aches and pains for a period of time, but not everyone experiences the same results.

However, the very specifically pulsed oscillating MERIT system of therapeutic magnetic energy obtains excellent results because it works at the cell level, not at the symptom or disease level.

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Neither radio frequency (30 kHz–300 MHz) nor microwave fields (300–3000 MHz) exist as significant components of the natural terrestrial electromagnetic radiation (EMR) environment. Today's human generation is the first to voluntarily expose itself to artificial radio frequencies and microwave fields that cover a wide spectrum of frequencies, pulses and intensities. While industry-sponsored studies have failed to show a clear link between exposure to cell-phone radiation and serious health risks, independent studies have confirmed one.

Recent reviews report of the effects of non-ionising EMR on health.¹ The conclusions, with recommendations for further research, illustrate the results are inconsistent while most studies are limited by lack of detail and fail to deal with a range of relevant factors. According to recent studies, radiation from third-generation (3G) mobile-phone towers transmitting signals for videophone may also damage a person's health. Such reports raise fresh concerns about their safety in both the short and long term, highlighting the need to adopt the precautionary principle.

EMR – the good, bad and ugly

The interaction of biological material with an EMR source depends on many factors. Of crucial importance is the frequency of the source — the rate at which the EMR changes direction, which is given in Hertz (Hz). One Hz is one cycle per second. X-rays have frequencies above one million MHz and are ionising. Cellular phones operate at 860–900 MHz, while AM and FM radio bands have a frequency around 1 MHz and 100 MHz respectively. The Global



System for Mobile Communication (GSM) network emits signals at the frequency of 900–1800 MHz. For the 3G network, the signal is around 2100 MHz. The signals transmitted between base stations are in a higher frequency range, 15–23 GHz, radiated by up to three dish-shaped antennae mounted near the top of the tower.

While ionising radiation can break chemical bonds (e.g., covalent), non-ionising EMR can have profound biological effects as well. For example, the blue-green wavelengths of visible light can delay the onset of melatonin production, while amber-red wavelengths do not when the photons of energy act on the receptors in the retina of the eyes.² The exposure of human beings or animals to light (visible EMR) at night rapidly depresses pineal melatonin production and blood melatonin levels. Likewise, the exposure of animals to various pulsed static and extremely low-frequency magnetic fields also reduces

melatonin levels.³ These are nonthermal effects that are most often disregarded by cell-phone company spokespersons. Telecommunication industry standards of exposure are thermally based and do not apply to chronic, nonthermal exposure situations.

Effects of microwave radiation

Microwave (300–3000 MHz) signals e.g., in 3G transmissions, travel through human tissue, metal, brick, glass and plastic. Human tissue absorbs microwave radiation. Even minute levels can produce demonstrable effects^{3–16}, including:

- opening of the blood–brain barrier, with the potential to allow chemical molecules, normally excluded, to enter the brain, with unknown consequences;
- disruption of brain activity, including altered brain waves and brain chemistry.

The range of physical symptoms

arising from cell-phone exposure and usage to 3G transmission facilities include:

- headaches and nausea
- memory loss and loss of concentration
- fatigue and lack of coordination
- mood swings and sleep disorders.

A Swedish study, headed by Dr Leif Salford¹⁷, reported exposure to EMR emitted by GSM cell-phones was associated with leakage of the blood–brain barrier and dose-dependent neuronal damage. In a separate recent study, three Dutch ministries found that radiation from 3G networks, emitting a lower dose than that for cell phones, significantly impacted on test subjects, who ‘felt tingling sensations, got headaches and felt nauseous’. For further information of the effects of mobile base stations on health, see also: www.mapcruzin.com/radiofrequency/cherry/neil_cherry1.htm.

While the collective body of evidence is more than sufficient to cause alarm, public health organisations continue to stall while the cell-phone industry builds more towers and expand into videophone and beyond. Mobile phones can and do save some lives in an emergency but, in contrast, should heavily populated communities be radiated regularly (and constantly in some places) to several volts per metre, with unknown cumulative long-term effects?

The WHO position on mobile phones, base stations and health, re-issued in January 2002, states: ‘None of the recent reviews have concluded that exposure to [radio frequency] fields from mobile phones and their base stations cause any adverse health consequences. However, there are gaps in knowledge that have been identified for further research to better assess health risks’.

3G base-station radiation

It is noteworthy that the 2G antennae for ordinary mobile phone network were

separated 3–5 km. The 3G antennae for videophone need to be 1.5–3 km apart. However, many of Hutchison's 3G antennae in Sydney are less than 1.5 km apart — 80 or so are within 300 m of local primary schools.

Measurements taken near cell-phone base towers in overseas countries allegedly have effective radiation powers that typically range from 400–4000 watts. This can result in 1 V/m at about 100–350 m from the base-station antenna. Overseas expert medical advice, from Dr Gerd Oberfeld and colleagues of Salzberg, recommends pulsing base stations should be below 0.02 V/m: www.plattform-mobilfunk-initiativen.at/englisch/pet99_eng.pdf.

While exposure to mobile phones is intermittent and typically of short duration, those from 3G base stations could be 24 hours a day, and persist for years.

Federal laws need amending

At the moment, there is no effective control over what the telecommunication carriers are doing in Australia. Due to the Federal *Telecommunications Act 1997* and its 1999 *Amendment*, a carrier's decision about where a low-impact facility (LIF) will be installed is immune from State environmental and town-planning laws, and from requiring development consent from the local government body. Thus the telco's decision is usually final, unless challenged in Court (see www.oatleypark.com). The carrier has only to 'show regard for' the Australian Communications Industry Forum Code (www.aca.gov.au/telcomm/industry_codes/codes/c564.pdf). Flouting of the 'precautionary principle' is commonplace, as is the abuse of powers and immunities on LIF given to them by the Federal legislation.

In the public interest, local councils should be empowered to give the approval of all telecommunication facil-

ities. The current immunity from complying with State planning laws presently conferred upon the carriers should be removed.

Humans not the same throughout

As a whole, populations are not genetically homogenous, and response to external cues, including visible EMR, varies widely. The consensus is that it is not currently possible to say that long-term exposure to 3G radiation, even at levels below national guidelines, is totally without potential adverse health effects. Biomedical researchers, with years of experience in the field, are not sure. Nobody really knows what the long-term consequences are e.g., by constant low-level exposures on children through their growth years, even when levels of exposure are extremely low. Such gaps in our knowledge justify a precautionary approach.

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One of the more contentious issues within the scientific community has been the question of biological effects from electromagnetic fields (EMF), and whether or not they adversely impact on human health. EMF are generated by anything that uses electricity, such as electric blankets, heated water beds, close proximity to power lines or use of mobile phones, etc.

For the purposes of this article, however, I will solely focus on 50 and 60 Hertz power frequency magnetic fields, which lies in the extremely low frequency (ELF) region of the electromagnetic spectrum.

The leukaemia link

In the West (Russian EMF research dates back to the 1950s), the first indication that power-line magnetic fields may be associated with ill health arose in 1979.

In that year, epidemiologist Nancy Wertheimer and physicist Ed Leeper released a study¹ that examined a number of environmental factors (air pollution, chemicals, formaldehyde from insulation, etc.) that might be associated with childhood leukaemia in Denver, Colorado. EMFs was not one of the factors they were examining.

However, during the course of the investigation, they noticed that many of the cancer patients' homes were in close proximity to power lines and step-down transformers. Using a 'wire code' electrical current classification to identify

estimated EMF exposure, they found a correlation (OR 1.5–3.0) between the children with cancer and high electrical-current homes.²

There has since been approximately 40 epidemiological studies examining the possibility of a connection between 50–60 Hz magnetic fields and various cancers, with the main emphasis on childhood leukaemia and, to a lesser extent, other cancers. As a result of this 25-year effort, there is now a growing scientific consensus from a number of pooled studies that the risk of childhood leukaemia is doubled at a prolonged magnetic field exposure level of 4 milliGauss (mG).^{3,4,5} No excess risk was seen at levels below the 4 mG level.

This level can be encountered in Australian home environments^{6,7} and is far below the current 'safety' guidelines set by the NHMRC in the early 1990s.

Only short-term safety regulated

The Australian Radiation Protection and Nuclear Safety Association (ARPANSA) is currently revising the Australian ELF exposure standard as a direct result of this consistent 4 mG finding. As a comparison, the old NHMRC ELF standard allows a 24-hour residential exposure of 1000 mG and a 5000 mG exposure for the workplace. These extreme limits do not even address the cancer issue. Keith Lokan, former head of the old Australian Radiation Laboratory, admitted this when he stated: 'These limits represent plausible field values, below which immediate health effects are unlikely. They are not intended to provide protection against possible cancer induction by continued exposure at lower field levels'.⁸ Hopefully, with the ARPANSA effort, that will soon change.

However, a question now exists as to what extent this is a problem in Australian homes. The UK's National Radiological Protection Board (NRPB),



while acknowledging the 4 mG finding, also claim that, 'In the UK, very few children (perhaps four in 1000) are exposed to 0.4 mcT' (4 mG).⁹ They then claim that for the 'general population', the risk is extremely small. However, for families with a child suffering cancer, this claim is cold comfort. Surveys in the US have found that at 4 mG, around a million children in the US alone are at increased risk for leukaemia.¹⁰ There is a larger percentage of high-exposure homes in the US compared to Europe and the UK due to different ways of distributing electricity.¹¹ The US also has an escalating incidence of childhood leukaemia, with a 62 per cent increase since 1971 — most likely due to environmental factors.

What about Australia?

As a direct result of the 4 mG findings, ARPANSA initially proposed to conduct a nationwide residential survey to try to determine EMF household exposure levels. However, this was later dropped because they claimed they could not get funding! Considering the close relationship between ARPANSA and the NHMRC, one wonders why funding was a problem.

Until funding arrives, we do not know the extent of the problem in Australian homes, but the important message is that for families with a child suffering leukaemia, there is now consistent epidemiological evidence that EMF exposure is a factor in the illness. Considering the scientific evidence, if the successful recovery of the child cancer patient is paramount, the possibility of excessive EMF exposure should be routinely checked as part of the treatment.

This can be achieved by lending out to parents (or carers) an EMF meter and survey program to enable them to survey the child's home environment, determine the sources of exposure and work out ways to eliminate or reduce excessive

EMF exposures. Such a program is already on trial in Australia, through the Ian Gawler Foundation and the Australasian College of Nutritional & Environmental Medicine (ACNEM) in Victoria.

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There is much controversy about the alleged effects of electromagnetic radiation (EMR) from such sources such as mobile phones, microwave ovens, and power lines. The debate includes numerous studies on both sides which purport to give a final and definitive answer. Nonetheless the issue has not been laid to rest and interest in the effects of radiation of all types on living systems remains on the research agenda.

Current scientific equipment is very well developed for perceiving one type of radiating energy: EMR. However, it is always dangerous to assume that simply because something cannot be seen or measured by *current* standards that it does not therefore exist.

Perhaps there is a need to distinguish between the currently accepted levels of radiation that can be measured in a repeatable way in the laboratory, and those that are qualitatively different or for which no scientific instruments currently exist — the so-called ‘subtle’ or ancient energies.

Ancient and modern energies

Modern energies, such as radio frequencies, X-rays and radioactive wavelengths, are at one end of the debate, the other end being held by subtle energies, which have their roots in the ancient esoteric traditions of most of the cultures of the world.

Measuring the effects of modern EMR with standard scientific equipment is relatively well established. There is, however, one important point to be made: *the radiation effects currently measured usually make no distinction between living matter and inert matter.* This is illustrated in the common guide-

lines on radiation, which primarily focus on the physical heating effects of radiation. The level in the late 1990s was thought to be at least four Watts/kg to produce adverse effects.¹² These thermal effects treat biological living tissue as effectively the same: as inert tissue or even simply water or other inert matter of comparative density. Recently this approach has been broadened to include consideration of the nervous system and person suffering from nervous disorders, such as epilepsy.

Many of the effects on living systems that have been alleged by low-level EMR have not been conclusively verified by purely physical electromagnetic measurements. But this may be because the purely physical effects, such as heating, are only a small part of the total picture.

Subtle energy has its place

It would be the author’s suggestion that, for living systems that are actively maintaining the dynamic equilibrium of life, the concept of subtle energy would be a useful addition. Although subtle energy is currently not easily measurable, it has a long tradition and is known by many names, such as *qi* in Chinese or *prana* in the Hindu tradition. It has always been associated with health and illness. The best instrument of its perception has traditionally been human perception and human consciousness itself. Being a different kind of energy and because of the subjective nature of its perception, subtle energy has hitherto fallen outside the scope of mainstream accepted scientific methods (see www.princeton.edu/~pear/sos.pdf).

Even on the personal level, however, it is usually the subtle energies that one refers to when using expressions such as, ‘I am low in energy ...’

Reality is usually defined by what human beings are able to perceive, either directly or indirectly using instruments and measuring equipment. Perceived



reality is further subdivided into the ‘accepted canon’ and the speculative, anecdotal and fringe. The canon of accepted reality has changed over the centuries and is certain to continue to change. Not all areas of knowledge can be held at the same time, and thus the focus of human knowledge shifts through the ages. Subtle energies may well be part of future increments in perceptual reality.

Unknown and unquantifiable

A common objection to subtle energies is the inability of current equipment to reliably measure it. While this is a valid reason for caution, it must be remembered that all currently scientific knowledge was at one stage in history outside the scope of acceptability.

Of course, being outside this scope is in itself not an argument for its inclusion or validation in the future. Yet in the case of subtle energies, it is well to remember the evidence of traditions in many cultures, and the actual ability to feel these energies directly in one’s body.

And, hopefully, in the future, we will develop a more objective method of measuring such subtle energies. ▀

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