

# BIOELECTROMAGNETIC AND SUBTLE ENERGY MEDICINE

SECOND EDITION



 **CRC Press**  
Taylor & Francis Group

EDITED BY  
**PAUL J. ROSCH, MD**

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*This book is dedicated to Marguerite, my late wife, without whose  
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# 47 Electrosensitivity

## *Sources, Symptoms, and Solutions*

Andrew Tresidder\* and Michael Bevington

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### CONCEPTUAL CONTEXT AND DESCRIPTION OF TERMS

*“Electrosensitivity doesn’t exist because it can’t!”* This was heard recently from an eminent authority, writer of many peer-reviewed papers on a number of health subjects. *“If it doesn’t heat tissue, it can’t cause damage!”* Two hundred years ago, eminent authorities might have denied the existence of electricity itself—as a mere fairy story told to amuse them—whilst some 300 years before that everybody *knew* that the sun revolved around the earth (that is until Copernicus published his *De Revolutionibus Orbium Coelestium*, just before his death in 1543). *“Electrosensitivity doesn’t exist because it can’t!”* is merely an evolutionary position of (mis)understanding, held at a point where a person does not yet comprehend the mechanism. Personally, though I learnt physics at medical school, the concept of electrons moving along a wire is as good as a fairy story to me—I’ve never seen an electron!—but I am happy to take the explanation on trust, and turn the switch and accept that the lights will come on!

Electrosensitivity (ES), Electromagnetic Sensitivity, Electromagnetic Hypersensitivity (EHS) or Idiopathic Environmental Intolerance is the phenomenon where the human organism experiences symptoms from exposure to the stimulus of electromagnetic (EM) fields of certain strengths and frequencies (including radiofrequency (RF) microwave transmissions), which symptoms then abate and disappear after the stimulus ceases. “Idiopathic” is a term coined from the Greek, used frequently with authority (as is much

medical descriptive terminology) and which means “suffering” (pathic) “from itself” (idio)—thus a term which actually says “it’s true, but I don’t understand the mechanism”—as in Essential, or Idiopathic Hypertension, a medical state which afflicts millions of patients in the world.

Failure to understand the mechanism does not invalidate the state that the patient is suffering—although it does make it less easy to heal rather than palliate a disease process—because if the mechanism is not understood, then it is less convincing to some people to approach healing resolution by the time honored medical approach of “Tolle Causam” (Latin for “Take Away the Cause”), that is, to recognize that biological organisms are designed to be healthy self-repairing devices with a default setting of restoring self to health, given the presence of the right (supportive) internal and external conditions and the absence of the wrong conditions (such as noxious stimuli). This may lead (as in the case of essential hypertension) to treatment of certain parameters to restore “normality” without healing resolution back to the design default of health—which is not the same as allowing the organism to be healthy again within a healthy environment. Remember that Pasteur, father of the “germ theory” of external causation by a single agent, said on his death-bed *“Bernard avait raison. Le germe n’est rien, c’est le terrain qui est tout.”* [Bernard was right. The microbe is nothing, the soil is everything]. Pasteur, L., quoted in Selye.<sup>1</sup> Thus even the great Pasteur was big enough to admit that his own understanding had only been part of the truth.

It is inappropriate to criticize those who do not yet understand, but to try to share current understanding—for society’s understanding is the product of our education and the

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sum and overview of our (often super-specialized) learning to date. As the Chinese proverbs say:

Man who looks at sky from bottom of well sees only small part of sky.

Man trained to use hammer sees many things as a nail.

In these days of the specialization of learning from early years, there is not always the cross-discipline understanding that there could be. For instance, most of biomedicine still ignores the insights from quantum mechanics and relativity, whilst within a single discipline there is often the danger of the development of “intradisciplinary group-think.” Of course such group-think may be right, or it may be wrong—but it will certainly always be the product of prevailing fashions, influenced by the prejudices of the times, and also by vested interests.

A wise professor at medical school told students that today’s heresy would be tomorrow’s dogma and then be held to be redundant knowledge in only a few years. For it is easier for all of us to cling to the security of what we believed yesterday, than to change our minds, as Copernicus found out—and wisely avoided excommunication and possible execution for heresy by delaying publication until he could avoid the consequences of a world hierarchy made angry by what he asserted. By the way, what did *De Revolutionibus Orbium Coelestium* do?—it turned on its head the prevailing world belief that the sun circled the earth (and not the other way around).

So this paper has been put together by a Classicist trained in cross-discipline thinking and a GP with a holistic view of health, led to the subject by personal experience and by experience which has helped a number of patients, affording unique insights and a motivation to look clearly at a subject with a desire to illuminate the area. The same authority quoted above as saying “Electrosensitivity can’t exist” also commented on the World Health Authority’s 2011 classification of RF transmissions as Class 2b (possible) carcinogens as being “Well it’s only Class 2b, it’s pretty weak and not important.” The same comments were probably uttered by eminent authorities about the “merely hypothetical and unproven” dangers from tobacco, asbestos and lead in petrol just a few short years ago.

When society faces important truths which are inconvenient (especially to vested interests) and require courageous action and leadership, there is a great tendency to denial on many levels, and a great temptation to “shoot the messenger,” pretend that the issue is either psychological, a placebo or nocebo response, a media driven psychosis, or discredit the patients’ honest stories, or threaten legal or other action. And some vested interests have powerful lobbies. However, though everybody is guided by best intention, they may not always see the whole picture. Throughout history, early (and unwelcome) messengers have been criticized, dismissed, vilified, or sometimes executed...

Technological advances usually benefit society and may move forwards rapidly—witness the Industrial Revolution, the spread of steam power and rail transport. Later we see

the spread of electricity, personal road transport (cars etc.), electronic communication and air travel. Safety considerations *always* lag the technological advances—and are often resisted vociferously by the industry concerned. The highest rate of road deaths per miles travelled by car was in the 1920s—in small part due to driver inexperience, but in large part due to little or evolving safety considerations. For example, until enough people died or were injured, the importance of adequate tread on tires was unknown—and then ignored—only finally being dealt with by legislation many years later. Another example is the resistance by car manufacturers to factory fitting of front and rear safety belts—presumably on the basis of human choice (to exit the vehicle through the windshield) but in reality on cost grounds.

Considering electrosensitivity, it is interesting that product liability insurance for health issues for mobile phones and other such transmitting technology is avoided by many of the major insurers who understand the potential risks. Perhaps they suspect something that the rest of us are not being told?

What is the biological basis for ES? We will approach this after noting the current classifications used worldwide—but not as yet in common usage in most countries.

## CURRENT CLASSIFICATION OF ELECTROMAGNETIC HYPERSENSITIVITY

*Nordic Council of Ministers* (2000): ICD-10.R68.8: “Electromagnetic intolerance” or “el-allergy” is a multi-symptomatic idiopathic environmental intolerance<sup>2</sup> (or ICD-10.Y68.8 for occupational cases). Symptoms disappear in a nonelectrical environment.

*WHO* (2005): EHS is characterized by a range of nonspecific symptoms. A more general term for sensitivity to environmental factors is Idiopathic Environmental Intolerance: IEI-EMF.<sup>3</sup>

*WHO* publication (2007) ES is “not a known psychological disorder.”

*Austrian Medical Association* (2012): ES as ICD-10.Z58.4

## BIOLOGICAL CONTEXT

Biological organisms are intrinsically electromagnetic. The trillions of humming cells in a human being each contain electrical DC current flows, and these currents coordinate together in synergy throughout the body. One example of a synergistic coordination detectable by gross electrical measuring devices is the electrical effect of billions of specialized cardiac cells—readable by all doctors as an ECG.

Our bodies were developed over millions of years against a background radiation level of minimal signal apart from solar flares. Current man-made signal levels are in places many trillions of times this level. Our bodies have developed organs of special sense which are exquisitely sensitive to certain frequencies of the electromagnetic (EM) spectrum—such as down to a photon or two of visible light, or a billionth of a

watt of sound. Amplification systems include cellular calcium and other mechanisms. It seems entirely possible that cells are sensitive to other RF as well. Animals across a wide range of species detect the tiniest of changes in magnetic fields for navigation and have been doing this for over 100 million years. This is a detection and response to EM fields of minute signal strength—not thermal power effects. There is growing evidence that man-made EM fields are disrupting this ability to navigate using the earth's magnetic field.<sup>4</sup>

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### Case Study 1

Case 1 is Mr P, aged 62, who presented with a two year history of regular headaches since moving house. A retired headmaster and IT teacher, he had no previous history of headaches despite a busy job. The headaches were frontal and occipital, and varied over time. The current house had the telephone socket in the bedroom, and the WiFi router adjacent. A signal detector confirmed a high field strength in the room and near the bed, of up to 3 V/m and over 1000  $\mu\text{W}/\text{m}^2$  (the normal background field strength in the environment is  $<0.02$  V/m and  $<1$   $\mu\text{W}/\text{m}^2$ ). The router, as per its technical design, generated signal 24 hours a day, and with up to a 50 m radius. He was advised to remove the router from the bedroom and switch it off whenever not in use, with the effect that he changed his exposure from 168 hours a week in close proximity to 10–20 hours at a distance. He was advised that it could take up to a week for his body to become symptom free, due to the phenomenon of Adaptation/Resistance (Selye) and the time taken for a healing resolution.

Blood tests were organized, and a brain scan considered. Two weeks after first presentation, he was able to confirm that four days after making the changes he had become headache free, and had remained so ever since. His words at the time were “I now feel as though I have been inside a microwave oven for some time—my headaches have gone and the itching of my head has settled.” Blood tests showed no abnormalities in Full Blood Picture (FBP), erythrocyte sedimentation rate (ESR), urea and electrolytes (UEs), or liver function tests (LFTs). The planned scan was deferred (and the cost saved). One year later he remains headache free, although prolonged exposure to transmitting technology can bring back his headaches.

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Sensitivity is the response of the organism to a stimulus. Sensitivity is characterized by the appearance of symptoms or signs in response to a stimulus, and the disappearance after removal of the stimulus. It is part of the body's design responses that enable discrimination between Self and non-Self, the monitoring of the environment and the organism's response to environmental pressures.

Most biological organisms are not only electromagnetic, but also inherently magneto-sensitive, with genes known as cryptochromes responsible for this ability.

The power effect of an EM RF field is measured in safety terms, according to the International Committee on Non-Ionizing Radiation Protection (ICNIRP), relevant to the thermal (heating) effects on tissue over six minutes. The signal effect of an EM RF field is the nonthermal effect on biology—and of course EM signaling is used widely by the body, in special sense organs, and throughout other tissues. All cells use very low potentials of DC current across membranes, so the body is already electrically sensitive. So to pretend that these nonthermal effects do not exist is to ignore elementary biology and physics; however it is an interesting line of thought for some to be diverted by, and no doubt convenient to certain vested interests.

It is not the purpose of this chapter to argue the merits of various safety limits, but we note that those of ICNIRP are being superseded around the world by far more stringent limits. There are always leaders and slow adopters; the UK has the unenviable record of being one of the late nations to severely restrict the use of x-rays in obstetric practice—up to 50 years behind some nations—when the incidence of childhood cancer was already suspected and proven to be a result of exposure *in utero*.

Specialized animal organs of sense include the eyes (sensitive in an adapted state down to a single photon), the ears (sensitive to environmental vibrations of minute amounts), the nose (sensitive down to a single molecule of some scents), and vibration (sensitive to minute movements, such as in the earthworm and others). There are other senses than the big five of sight, hearing, taste, smell and touch—some birds are known to navigate by a magnetic compass developed over 90 million years ago, whilst magnetotactic bacteria stem from ancestors from two billion years ago. In pigeons, the inclination sensitivity of the magnetite receptors in the beak is between 0.02 and 0.17 degrees, down to 0.01  $\mu\text{T}$  (10 nT) (incredibly sensitive!). (By comparison, the earth's magnetic field is 50  $\mu\text{T}$  (50,000 nT), whilst current ICNIRP safety limits for magnetic field exposure are 100,000 nT, and the recent Bioinitiative report proposes a limit for chronic exposure of 100 nT.)

Human cryptochromes are shown to be magnetosensitive.<sup>5</sup> The human brain also contains magnetite, particles synthesized within the body (for what purpose?) of 10–70 nm, of 90–200 nm and some of 600 nm size.<sup>6</sup> In the pia and the dura, there are over 100 million crystals per gram—and the larger particles could transduce a 50 Hz field at 0.4  $\mu\text{T}$  (as well as mobile phone frequencies).

Hypersensitivity, whether due to allergens such as pollen and house dust mite giving respiratory symptoms, due to food components giving rise to urticaria, or other allergens, is considered to be the result of antigen/antibody complexes. It results in type 1, 2, 3, or 4 hypersensitivity reactions. Although electrical fields have physical mass, everybody thinks that they cannot be antigens that fit into a receptor on the cell's surface (because they are “too small to be physical antigens”)—so it requires a small conceptual step to remember that the symptoms of sensitivity reactions are generated by inter cell signaling, and that inter cell signaling occurs as

a result of individual cell reaction, again modulated by signaling. What is the nature of this inter- and intracellular signaling? We know that neurotransmitters diffuse at a speed of a few cm/s, and nerves transmit electrical impulses at speeds of up to 6 m/s—both of which are painfully slow compared to the speed of thought or of reactions from the cerebellar system as we walk over rough ground. However, it is the cell membrane that acts as a physical and insulating barrier (with protein molecules in the walls which may act as semiconductors), with different concentrations of ions between inside and out—and different electrical potentials. In fact, there are continuous minute DC currents in action both inside and outside cells, with changes in function mediated by switching (like a transistor semiconductor in electronics) in response to changes in potential due to ion gradient changes. For instance, as a response to injury, a cell membrane allows an influx of  $\text{Ca}^{++}$  ions down a huge concentration gradient, with major resultant changes in function and behavior. Initially a cell may respond to this stimulus by repair, but continued noxious stimuli in excess of the capacity of the repair mechanism result in ongoing damage and production of free radicals with resultant disordered function and, at a cellular level, ill health. Study of the field of calcium metabolism in living organisms has been led at Imperial College, London by Andrew Goldsworthy.

Nerve cells send off signals that are assumed to reflect activity from the organ they innervate—just as a telephone wire carries a clear signal from one person to another. However, if the wire itself is damaged, bent, broken, or wobbled, then the signal becomes distorted. Skin cells repair themselves, and carry out normal functions—however if irritated or damaged, histamine and other responses can result, with rashes or irritation being the body reaction.

It is entirely possible that sensitivity symptoms can originate either from irritation of the tissues which send a distress message, or from disruption of the nerve cell function or other signaling mechanism, or from an inherent sensitivity to the signal effects.

Human beings, in common with other mammals, have a design default of “health”—and a physiology designed to restore health after noxious insults. However, there is a “bucket effect.” The organism can cope with only so much insult at a time, and only so much in total, before vitality is eroded. The bucket can process insults A, B, C, D, E, and F perfectly adequately—one at a time and in isolation. However, put ABCDE and F all together at the same time, the bucket overflows, and the organism becomes overwhelmed. Health then degenerates into a disease state—preceded by symptoms of sensitivity as the organism seeks to restore balance.

Many humans feel headaches before a thunderstorm, arising from an increased electrical tension in the atmosphere (irrespective of barometric pressure changes). The headaches resolve when the storm has broken. This is a normal phenomenon of electrosensitivity, known personally to many people.

Geomagnetic storms arise from charged particles from the sun. Those of interest last one to five days at around 100 nT. Acute health effects in humans observed include an

increase in depressive illnesses, melatonin disruption, heart rate variability, and blood pressure changes,<sup>7</sup> whereas in bees a magnetic storm day resulted in a change in nest-exiting directions.<sup>8</sup>

Ants lose their ability to forage,<sup>9</sup> with changes in linear and angular locomotion, when exposed to RF signal such as that from wireless equipment like mobile phones, smartphones, digital enhanced cordless telephone (DECT) phones, WiFi routers—and can die.<sup>10</sup> The authors wryly note “One very elegant feature of using ants as experimental animals is—as for other animal species, plants and bacteria—that they do not lend themselves to psychological explanatory models, such as mass media driven psychoses. If they react to artificial electromagnetic fields, it is not because they have listened to radio broadcasts, watched the TV news or read columns in tabloids. No, then they do react to the actual adverse environmental exposure.”

Fruit flies are also particularly sensitive to RF signals.<sup>11</sup> All EMF sources used created statistically significant effects regarding fecundity and cell death-apoptosis induction, even at very low intensity levels (0.3 V/m bluetooth radiation), well below ICNIRP’s guidelines, suggesting that *Drosophila* oogenesis system is suitable to be used as a biomarker for exploring potential EMF bioactivity.

*Human health* is a delicate balance. It can be adversely affected by interfering factors including chemical pollution, smoke, pollens, molds, the food we eat, what we drink, lack of sleep, lack of fresh air, lack of sunlight, lack of fresh water and so on.

Observed effects and possible mechanisms of EM fields and RF transmissions include calcium ion influx into cells, autonomic upregulation, disruption of endocrine balance and melatonin production, heat shock protein stimulation, blood–brain barrier interference, radical pair spin disruption due to the Zeeman effect discovered in 1896 (causing breaks to appear in DNA due to failure of recombination), transduction effects around magnetite particles in the brain and interference with body intracellular signaling systems. As a noxious stimulus with biological effects, it would be surprising if the presence/absence of EM fields did not have effects on human health synergistically with all the other factors noted above—and for a sensitive being such as a human, the first things to be noticed may be symptoms rather than gross tissue pathology...

Agarwal<sup>12</sup> in Cleveland published an observational study correlating mobile phone use with decrease in sperm quality, the review by Vignera et al.<sup>13</sup> confirms this across species including man, whilst Gye and Park<sup>14</sup> from Korea reviewed the adverse effects of EM field exposure on sperm, germ cells, endocrine hormonal cycles, embryonic development and pregnancy success.

In view of the biological provenance, and the proven biological effects of weak extraterrestrial electromagnetic fields on human health and symptoms, and the adverse effects on biology of many species including humans—it would be indeed surprising if some human beings did *not* have symptoms from electromagnetic fields, especially those way



in excess of the background adaptive level. Readers of the other chapters in this book may not be surprised by this— if therapeutic physical effects can be achieved by weak EM fields—then it is not stretching credibility to think that mere symptoms could also be caused by EM fields!

Electromagnetic (EMF) pollution may be the most significant form of pollution human activity has produced in this century, all the more dangerous because it is invisible and insensible.

**Dr. Andrew Weil, MD**

Genuis and Lipp (2011) have published a comprehensive paper titled “Electromagnetic Hypersensitivity: Fact or Fiction?” which scopes and analyzes the whole field from an orthodox scientific view, complementing the present article which seeks also to give philosophical context and biological rationale.<sup>15</sup>

## SYMPTOMS

Many studies list symptoms from mobile phones and masts, radio and TV masts, and power lines.<sup>16–51</sup>

*Symptoms* may be none, or include tiredness, poor quality sleep, irritability, heart palpitations, headaches and a feeling of pressure in the head, speech and thinking disturbance, brain fog, dizziness, tinnitus, vertigo, tinglings and odd sensations in the limbs, joint pains, rashes, and others.

*Prevalence of EHS:* many studies give 3%–5% of the general population.<sup>52,53</sup> The WHO (2005) stated: “A survey of occupational medical centers estimated the prevalence of EHS to be a few individuals per million...a survey of self-help groups yielded much higher estimates. Approximately 10% of reported cases of EHS were considered severe... The reported incidence of EHS has been higher in Sweden, Germany, and Denmark, than in the UK, Austria, and France.” Others suggest 3% show severe symptoms, 35% moderate and up to 50% mild.

*Prevalence of Doctors accepting ES:* In 2009 29%–58% of German GPs “associated EMF with health complaints,”<sup>54</sup> and in 2006 Swiss GPs “judged the association...plausible” in 54% of cases.<sup>55</sup> The Austrian Medical Association issued EHS guidelines in 2012.

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## Case Study 2

Case 2 is Mrs S, a 54 year old female. I found her a credible and truthful witness. She gives a history of symptoms of severe head pain, nausea, dizziness (which can make her faint), chest pain, tingling skin/nerves, blanks in her visual field of up to 50%, insomnia resulting in constant tiredness and an inability to concentrate or remember things as a result of all of these. She has identified that these symptoms are brought on when she is in the vicinity of WiFi, mobile phones and “smart” technology, although she suffered for several years before making this link. Having made the link, she is able to avoid them

as much as possible, and when free from them becomes symptom-free.

She describes times when her thoughts feel jammed, unable to remember pupils’ names, and a train of thought disappearing. Initially concerned that she might have a brain tumor, she sought help from her GP and a Neurologist. Fortunately investigations have ruled out such a cause.

However, she became so ill that she was unable to continue working in her post as a Secondary School Teacher and had to hand in her notice. At this point she had not yet identified the environmental triggers of wireless technology that cause her disability and illness. Since then, she has had exposure levels measured at work, and found that they are extremely high, at between 3 and 6 V/m—many sensitive people are symptomatic at as little as 0.02 V/m, and the ambient level in a wireless free house is <0.02 V/m.

She has, of course, eliminated all wireless technology from her home, however the school environment has high levels of wireless signal, widespread use of mobile phones, and uses smart technology such as interactive whiteboards. It is therefore not possible for her to work there. Other schools have similar levels of use of wireless technology.

She has been supported by her GP and by her NHS Neurologist, both of whom have noted the connection with wireless technology. Her GP and neurologist suggested using amitriptyline and dosulepin to downregulate her sensitivity (not as antidepressants) but these agents were not effective.

Currently, when exposed to domestic wireless technology, such as on a recent visit to a relative’s house, she rapidly becomes symptomatic within minutes to the extent of disability and an inability to concentrate sufficiently to drive. She is unable to stay in houses, hotels or other accommodation with wireless technology without becoming symptomatic, sometimes severely. She describes passing certain mobile phone masts on roads and feeling severe symptoms as though someone was trying to stick an axe through her head, a feeling that abates when she has passed the mast.

An area with good signal coverage is in effect a polluted area which gives rise to increasing symptoms for Mrs S.

This is a clear history of neurological and other system symptoms in response to environmental exposure to transmitting technology, and which abate when exposure ceases.

---

*The diagnosis is electrosensitivity (severe degree),* a diagnosis understood in Sweden for many years, but only recently becoming known by the medical community in the UK. Indeed, many physicians may not yet have heard of it, and certainly did not learn about it at medical school. Fortunately, the Austrian Medical Association (2012) adopted a guideline for differential diagnosis and potential treatment of unspecific stress-related health problems associated with electrosensitivity including wireless signal pollution. Its core element is

a patient questionnaire consisting of a general assessment of stress symptoms and advice on specific assessment of electro-smog exposure. The guideline is intended as an aid in diagnosing and treating EMF-related health problems. It is thought that perhaps 20% of the population are mildly affected (and may not realize), around 3%–5% moderately, and less than 1% severely affected. In Sweden, the illness/disability is recognized as such, and taken account of by medical and other approaches.

The condition is managed by attention to health, and above all by avoidance of unnecessary exposure. Should Mrs S be exposed to levels of wireless signal for more than short periods of time, her ability to recover from each episode of exposure is likely to diminish, her level of functioning during that time will be impaired and her health will further suffer.

The implementation of transmitting technology has been rapid (in evolutionary terms) and current UK safety levels for exposure are based largely on thermal heating effects of electromagnetic radiation. We are becoming aware that the signal (not power) effects of transmitting radiation affect biological

systems by a number of mechanisms including upregulation of the adrenocortical axis, affecting the blood–brain barrier, calcium influx into cells, and disruption of inter- and intracellular signaling (a bit like jamming the enemy’s radar...). As yet, UK safety exposure limits take little account of these factors.

The following Table 47.1 is of symptoms noted over a series of years of research.

#### NOTES ON SYMPTOMS

- *Accumulation.* Cumulative exposures can produce symptoms, making symptoms from chronic exposure more difficult to recognize than from acute exposure.<sup>56</sup>
- *Delay.* Symptoms can be delayed after acute exposure for a few hours<sup>32,57</sup> or even days. This is said to become more common the longer the patient has been sensitized.
- *Diurnal state.* Symptoms vary according to the diurnal state of the person’s body. A person’s own

**TABLE 47.1**

#### Symptoms

|  |                         |   |                                    |
|--|-------------------------|---|------------------------------------|
| <i>Auditory</i>                            | <i>Dermatological</i>   | <i>Musculoskeletal</i>                  | <i>Ophthalmologic</i>              |
| Earaches                                   | Brown “sun spots”       | Aches/numbness/pain/prickling           | Eyelid tremors/“tics”              |
| Imbalance                                  | Crawling sensations     | sensations in bones, joints and muscles | Impaired vision                    |
| Lowered auditory threshold                 | Dry skin                | in ankles/arms/elbows/feet/hips/legs/   | Irritating sensation               |
| Tinnitus                                   | Facial flushing         | lower back/neck/pelvis/shoulders/wrist  | Pain/“gritty” feeling              |
|  | Growths and lumps       | Cramp/tension in arms/legs/toes         | Pressure behind eyes               |
| <i>Cardiovascular</i>                      | Insect bites and stings | Muscle spasms                           | Shiny eyes                         |
| Altered heart rate                         | Severe acne             | Muscular paralysis                      | Smarting, dry eyes                 |
| Chest pains                                | Skin irritation         | Muscular weakness                       |                                    |
| Cold extremities especially hands and feet | Skin rashes             | Pain in lips/jaws/teeth with amalgam    | <i>Other physiological</i>         |
| Heart arrhythmias                          | Skin tingling           | fillings                                | Abnormal menstruation              |
| Internal bleeding                          | Swelling of face/neck   | Restless legs                           | Brittle nails                      |
| Lowered/raised blood pressure              |                         | Tremor and shaking                      | Hair loss                          |
| Nosebleeds                                 | <i>Emotional</i>        |   | Itchy scalp                        |
| Shortness of breath                        | Anger                   | <i>Neurological</i>                     | Metal redistribution               |
| Thrombosis effects                         | Anxiety attacks         | Faintness, dizziness                    | Thirst/dryness of lips/tongue/eyes |
|  | Crying                  | “Flu-like” symptoms                     |                                    |
| <i>Cognitive</i>                           | Depression              | Headaches                               | <i>Respiratory</i>                 |
| Confusion                                  | Feeling out of control  | Hyperactivity                           | Asthma                             |
| Difficulty in learning new things          | Irritability            | Nausea                                  | Bronchitis                         |
| Incoherent talk (temporary or permanent)   | Logorrhoea/verbosity    | Numbness                                | Cough/throat irritation            |
| Lack of concentration                      | Mood swings             | Sleep problems                          | Pneumonia                          |
| Short/long-term memory impairment          |                         | Tiredness                               | Sinusitis                          |
| Spatial disorientation                     | <i>Gastrointestinal</i> |   |                                    |
| Spoonerisms                                | Altered appetite        |   | <i>Sensitization</i>               |
|  | Digestive problems      |   | Allergies                          |
|  | Flatulence              |   | Chemical sensitivity               |
|  | Food intolerances       |   | Light sensitivity                  |
|  |                         |   | Noise sensitivity                  |
|  | <i>Genito-urinary</i>   |   | Smell sensitivity                  |
|  | Smelly sweat/urine      |   |                                    |
|  | Urinary/bowel urgency   |   |                                    |

Source: Adapted from Bevington MJ. *Electromagnetic Sensitivity and Electromagnetic HyperSensitivity: A Summary*. Capability Books: Bucks; 2013. With permission.

endogenous electromagnetic field often declines during the day.

- *Duration.* Individual symptoms can last for a short or long time. As a group symptoms can become worse. They can fade after two to 12 months without electromagnetic radiation (EMR) exposure.
- *Frequencies.* The sufferer may react first to a single frequency or source but later to more (e.g., first to WiFi but later to mobile phones and power cables).
- *Intensity.* As the condition progresses the level of sensitivity can increase: a person may first have pains from a phone next to the head but later from one at three meters.
- *Ionizing similarities.* Studies indicate symptoms from exposure to electromagnetic (non-ionizing) radiation are similar to those from radioactive (ionizing) radiation.
- *Severe reactions.* Severe reactions can include paralysis, convulsions, seizures, loss of consciousness and stroke, or they can exacerbate an existing medical condition.
- *Variety.* Individual variation in tissue/bone density, acidity, salt content, skin conductivity, size, and so on, affect absorption.<sup>58</sup> This may relate to the variety of symptoms.

## SOURCES OF ELECTROMAGNETIC RADIATION

Human beings, as other organisms on the planet, developed over millions of years in an environment of day and night, seasons, blue (sky) and green (plants), and a background EM field from the earth of around 50  $\mu$ T—with NO man-made artificial sources.

One hundred and fifty years ago there was no such thing as mains electricity—and the only high voltage phenomena were the natural ones of lightning discharges.

A hundred years ago mains electricity using alternating current was in its infancy—it is now ubiquitous. Milham has chronicled the interesting epidemiological phenomenon of child leukemia remaining rare in rural USA until electrification in his seminal book *Dirty Electricity*.<sup>58</sup>

Fifty years ago wireless technology meant television, radio, and radar. The only home transmissions were for radio hams (home radio transmitting enthusiasts)—who knew all about the dangers of being too close to the transmitter. Cordless phones, mobile phones and masts, and microwave movement detectors such as in home alarm systems were all dreams for the future, let alone wireless routers, wireless central heating controls, interactive whiteboards, smart meters, Blackberries, iPhones and laptop and palm computers that can only work by wireless.

Electromagnetic problems for biological organisms, including humans, are caused by

1. *Field effects* from cables and appliances (such as lights, hairdryers, washing machines, cookers, bedside radios, etc.).

2. *Signal and power effects* from microwave transmitting technology, such as microwave ovens, mobile phone masts, cordless phone base stations and handsets, mobile phones, wireless routers, Wii devices, laptop computers, printers, home and office alarm sensors, iPads, Blackberries and other smart phones, baby alarms, smart meters for utilities, wireless central heating controls, and Bluetooth devices in the car.
3. *Dirty electricity*—This is the phenomenon of (jingly) transient high frequency harmonics in mains electricity supplies superimposed on the (smooth) 50 Hz sine wave—sources are rapid switching devices such as in computers, and so on, fluorescent lighting, dimmer switches, and ingress from external sources such as mobile phone masts.

Table 47.2 gives an overview of sources.

There are individual risk studies.<sup>59–62</sup> For total RF exposure, the most frequent risks are: phone masts, mobile phones and DECT phones.<sup>63,64</sup> MF exposure is highest at home.<sup>65</sup>

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### Case Study 3

*Electrosensitivity—A Personal Story—Dr. Andrew Tresidder MBBS MRCP*

I've always considered myself healthy, but had mumps as a junior doctor. This hit me so hard that I had to take three months off work, for it took this long to recover my energy—a post-viral fatigue (with the virus being mumps). As a result, I have always been more aware of my vitality levels (how much charge there is in the batteries) and more sensitive to things than many people—for instance, for years after the mumps, coffee and tea would give me a headache, whilst other negatives would make me feel depleted with aches in my parotid glands, the original site of the mumps. Coincidentally, finding in the Practice Library a copy of Dr. Richard Mackarness "Not All in the Mind" gave me valuable insights to explain food intolerances and their impact on health.

One summer I returned from holiday to find the computer screens had been changed. My small black and white monitor had been changed for a larger color cathode ray tube (CRT). Within hours of sitting in front of this, I felt sick and unwell. The same happened the next day, and the next, with recovery after avoiding exposure—so we changed the cathode ray tube for a flat screen monitor (at a time when they cost £700), and I felt well again. (A flat screen works on just a few volts, whereas a CRT bombards your body with charged particles if you sit too close—children are always told not to sit too close to the television...)

The next electromagnetic insult was the first time I used a mobile phone—I developed a marked headache and slurred speech within seconds. Ever since, I have used mobiles and cordless phones (which have a similar,



though less intense, effect) as minimally as possible. Instead, I use a corded phone on a landline whenever possible, and ring people back using one of these. Each time I use a mobile phone to my head, I still get the headache. So I use an earpiece and have the phone several feet away from me. (Remember from physics that the intensity of the field diminishes with the inverse square of the distance—so a phone say 1 cm away from your head has a field 10,000 times stronger than when it is a meter away.)

At work, I changed the fluorescent tubes for spot lighting, as this is softer and feels more comfortable. I am also able to look out the window at some plants, which is very calming.

With our last photocopier, I was unable to sit near it, especially if the computer a few feet away was on—the combined effect was most uncomfortable. The current photocopier has a less intense effect, but I still avoid being near it.

More recently I develop mild headaches on the motorway or road when approaching a mobile phone mast—the symptoms abate as I drive away again.

Bluetooth in a car gives me an intense headache immediately, as the phone and device are in constant wireless contact.

Most recently we changed internet service provider to a large British one, who sent a wireless Home Hub. Thirty seconds after switching this on, I developed an intense headache, the Hub being a few feet from where I sat at the computer. So I have returned to a wired router and a Local Area Network that uses the mains wiring system of the house.

I have a device that detects mobile phone, cordless phone and WiFi and mast frequencies—needless to say it goes off very loudly with all of these.

At work, when the building was extended, we changed the alarm sensors from passive to active/passive. By the end of the first day I had a headache and felt irritable—but it took a few days for me to realize that the new sensor was the cause. Removing it made me feel better in my room, but I became more and more fragile in the rest of the building, to the point that I had to leave meetings after half an hour. So we had the whole building changed back to passive sensors. A week later, several of our receptionists said to me how much better the atmosphere felt, and one senior colleague stated “I’m not sure I did believe in this, but I have to say I feel much better, and think there is something in it now—it was right to have them removed.”

And in another workplace, one day I felt a headache developing within minutes of sitting at my desk. And then I opened the email that said how the WiFi system in the building had just been upgraded. The building is also only a few hundred meters from a major mobile phone base station, so I minimize my exposure due to the headaches I develop there, and the muddled thinking that occurs after an hour.

A recent trip meant that I spent the best part of three days in a WiFi enabled hotel in a city, and was unable to get out from it much. Interesting...first the strange dull headache, then the slight irritability, then mild fatigue. Also, presumably due to the duration, or the intensity, of the exposure, a tingling in my lips and metallic taste, and a sensation in the front of my mouth, as well as a runny nose (not the same as a cold), which lasted a few days. Of course, removing self from exposure helped. It was very interesting to then use an electrosmog detector—scary... and how about everyone else...

Changing my car recently gave me problems—my head felt unsteady and my legs ached—I was suspicious that there was an in-car alarm system and high magnetic fields round the legs from the alternator and wiring loom. Actually the problem was partly too much static electric charge in the car, so an earthing strip has partially eased my symptoms in the car; however, there are high magnetic fields in the front of the car which continue to cause a problem—some other cars with lower fields feel much less tiring to drive.

Some people use a silver bobbinet canopy to sleep under, to protect themselves in a type of Faraday cage, or wear protective clothing.

An engineering friend once told me that a microwave oven tester said that if his mobile phone was an oven, it would have been condemned as too dangerous because of the RF emissions, and also that as a radio ham in the 1970s he would have lost his UK license had he constructed a transmitter of the same power as a domestic WiFi hub.

Putting all this together, I would diagnose myself as electrosensitive.

I have been fortunate in all these cases to recognize the cause—and eliminate it, thereby stopping myself feeling ill. Unfortunately, there is a phenomenon called tolerance.

Tolerance is when your body has an alarm symptom to a nasty stimulus—but if the stimulus is continued, it downgrades the symptoms so you don’t notice—but damage is still happening under the surface. Many people feel quite ill with their first cigarette—but as they continue to smoke, they get used to it. This explains why when I was explaining this to a doctor friend recently, she said, “Yes—I got a headache when my husband put in WiFi—but it wore off after four days.” Classic alarm symptoms followed by tolerance (but with long-term ill effects likely). The General Adaptation Syndrome of Prof Hans Selye neatly explains the mechanism of tolerance, but unfortunately is not taught at most medical schools.

There are lots of people who have developed a level of tolerance, or resistance—but this actually is resistance to an ongoing harm, which will (like being exposed to other noxious stimuli long-term) cause immune system dysfunction and other adverse effects on the body, leading eventually towards illness.

One important concept in the field of health and of understanding contributory causative factors of ill health and illness is that of a maintaining cause.

If you have a stone inside your shoe—no matter how many times you change your socks, develop super strength support socks, use special pressure relieving calipers, or take cleverly designed pain killers—every time you walk on that foot, the stone will jab in and give you pain. The only (and very simple) answer is to remove the stone...

### TOLERANCE, ADAPTATION, AND LONG-TERM HARM; TILT AND KINDLING

Selye's General Adaptation Syndrome is of particular relevance here. An individual, exposed to a noxious substance or stressor, may first experience an Alarm reaction, next develop an outer appearance of Tolerance (Resistance), and then reach a final stage of Exhaustion. Repeated stimuli exhaust

**TABLE 47.2**

### Sources of Electromagnetic Fields and Signals Causing Human Sensitivities

| Higher Risk  | Lower Risk   | Risk for Sensitized  |
|--|--|--|
| <i>Depending on proximity and length of exposure</i> | <i>Depending on proximity and length of exposure</i> | <i>Depending on the sensitized frequencies and other factors</i> |
| <i>Personal</i>                                      | <i>Personal</i>                                      | <i>Personal</i>  |
| Laptops  | Bluetooth headset                                    | Electric wrist watches,  |
| Mobile phones  |  | Mercury amalgam fillings,  |
| Tablets  |  | Metal-framed spectacles,   |
|  | <i>Household</i>                                     | Metal prostheses,  |
|  | Baby digital alarms,                                 | Other people retaining EMR,                                      |
|  | Computer screen,                                     | Water exposed to EMR on skin                                     |
|  | Electric garage door motors,                         |  |
|  | Electricity from some solar panels,                  |  |
|  | Hairdryers,  | <i>Household</i>   |
|  | Some energy-saving bulbs,                            | Compact fluorescent lights,                                      |
|  | <i>Blocks of flats:</i>                              | Computer keyboard,   |
|  | Incoming main electric cable                         | Computer mouse,  |
|  |  | Delivery signature devices,                                      |
|  | <i>Neighborhood</i>                                  | Dishwashers,   |
|  | Mobile phone masts >400 m,                           | Electric cookers,  |
|  | Neighbors' DECT phones,                              | Fluorescent tubes,   |
|  | Neighbors' mobile phones,                            | Fridge electric motors,  |
|  | Neighbors' WiFi,                                     | Inkjet printers,   |
|  | Neighbors' wireless smart meters,                    | Large fan electric heaters,                                      |
|  | Substations,   | Metal-sprung mattresses,   |
|  | Underground power cables                             | Microwave detection sensors,                                     |
|  | WiFi, hotel, shops                                   | Microwave ovens,   |
|  |  | Plasma TV monitors,  |
| <i>Area</i>  | <i>Area</i>  | Satellite dishes,  |
| Airfield radar                                       | Area WiFi,   | Stereo speakers,   |
|  | WiMAX,   | Under-floor heating,   |
|  | Radio transmitters <2 km,                            | Washing machines   |
|  | TV transmitters <2 km,                               |  |
|  | Satellite broadcasts,                                | <i>Neighborhood</i>  |
|  | Satellite communications                             | Ambient mobile use, especially during rain or                    |
|  |  | far from mast,   |
|  | <i>Travel</i>  | Electronic security detectors,                                   |
|  | Aircraft,  | Loop hearing systems,  |
|  | Electric cars,                                       | Radio frequencies on wiring or power cables,                     |
|  | Electric trains                                      | Radio microphones,   |
|  |  | Road radar and celllar,  |
|  |  | Some electric cars,  |
|  |  | Street lights  |
|  |  | <i>Area</i>  |
|  |  | Aircraft ground radar  |

Source: Bevington MJ. *Electromagnetic Sensitivity and Electromagnetic HyperSensitivity: A Summary*. Capability Books: Bucks; 2013. With permission.

the organism, and repeated stimuli may bring about a variety of alarm symptoms from the autonomic nervous system and other mechanisms. Long-term degenerative harms and chronic disease are inevitable in this well-accepted model.

*Toxicant-induced loss of tolerance (TILT)* has been proposed as a methodological approach to identifying the trigger process. Toxicant-induced loss of tolerance can be seen as leading to *Sensitivity-Related Illnesses (SRI)*.<sup>66</sup> Electromagnetic-sensitivity shares features of other SRI, or environmental intolerances. SRI are triggered by low-level xenobiotic environmental toxic exposures. Alterations of catalase, glutathione-transferase, and peroxidase detoxifying activities correlate with Multiple Chemical Sensitivity, with 80% overlap with EHS.<sup>67</sup>

*Kindling* is the repeated stimulation of an organism at initially subthreshold levels which results in hypersensitivity. Once the organism is charged or kindled, it can sustain a high level of arousal with little external stimulus. It may also result in oxidative stress.<sup>68</sup>

## ES DIAGNOSIS

The mainstay of diagnosis is a good *history*, of health problems and EMF exposure, and particularly of resolution of symptoms when removed from the stressors/noxious stimuli. Observation from a third party can be useful to corroborate the story. Exclusion of other diagnoses is important (e.g., in Case Study 1, the physician had in mind many possible diagnoses of physical causes, however never proceeded beyond blood tests to expensive scans, and so on, because of the rapid and complete resolution of symptoms by removal of the patient from exposure). Measurement of EM fields with simple inexpensive meters such as electrosmog detectors, and EM field detectors is valuable (and in Case Study 1 led to self-diagnosis and treatment).

The Austrian Medical Association Guidelines of 2012 are most helpful and are available on the web at this site amongst others: <http://electromagnetichealth.org/electromagnetic-health-blog/oak-emf-guidelines/>. They look at the problem comprehensively and give useful protocols, questionnaires and further information, including on testing for signal and EM fields.

*Examination findings* may be normal, or may show signs of sympathetic upregulation.

*Pathological markers* are not widely known in the USA or UK. The following are used around the world by leaders in the field, who must be considered as pioneers:

1. *Cerebral brain perfusion scans*: (Prof Belpomme)—Seem fairly convincing proof on a case by case study of ES sufferers.
2. *Environmental bioregulation of the autonomic nervous system*: Tests for the adaptability of the bio-system to pulsed high frequency EMFs and thus diagnosis of electrosensitivity, its extent and pre-existing damage. In three phases, resting, exposure and recovery, in a single blind test; exposure from a DECT phone at  $1000 \mu\text{W}/\text{m}^2 = 0.6 \text{ V}/\text{m}$ .

- a. *Heart rate variability and bandwidth* (distance between ECG R-peaks, with spectral analysis (fast Fourier transform, FFT) to the base signal and its harmonics). EHS results: a lower heart rate variability (HRV) in the harmonic frequencies. A limited resting HRV can show pre-existing and irreversible damage of the vagus nerve stimulation (VNS).
- b. *Microcirculation* (Laser Doppler imaging at the earlobe). Results: microcirculation is controlled by the VNS, thus showing bioregulation.
- c. *Active electrical skin potentials* (a sensor on the left lower arm) for stress and blockages. (Dr. Lebrecht von Klitzing, Wiesenthal, Germany. [www.umweltphysik.com](http://www.umweltphysik.com).)
3. *Pulsed echo-doppler brain scan*: A decrease in the pulsatility of several brain areas; *blood stress proteins* increased; *urinary melatonin* decreased (in 50% of patients).  
To identify two phases of the “EMF Intolerance Syndrome”: (a) headaches and neurological problems, heart rhythm disturbances, and concentration difficulties; (b) three chronic symptoms, insomnia, fatigue and depression, sometimes with memory and behavioral problems, irritability, aggression, and suicidal tendencies. (Professor Belpomme, France, and ARTAC.)
4. *Multiple parameters*. Tests with three types of EMF (50 Hz, modulated RF and unmodulated RF), latent reaction periods, assessment of previous home and work EMF exposure, EEG, ECG, blood analysis, psychological and physiological tests, assessments of the thyroid and adrenal glands, and the brain alpha-rhythm. (Centre for Electromagnetic Safety, Moscow, 2009.)
5. *Lymphocyte chemical sensitivity*. A blood test for lymphocyte sensitivity, against seven common allergens (benzoate, burnt petrol exhaust, formaldehyde, metabisulfite, natural gas, nickel, salicylate) before and after EMF exposure. Exposure to chemicals to which someone is sensitive can increase calcium levels inside white blood cells which are further increased by EMF exposure. Calcium displaces magnesium in the cell, interfering with ADP/ATP metabolism, producing fatigue. (Dr. John McClaren Howard, Acumen Laboratories, 2008.)
6. Neurochemical marker antibody evaluation may signify screen dermatitis.<sup>69</sup>
7. *Skin conductance* may indicate a greater likelihood of electrosensitivity.<sup>70</sup>
8. *Photodermatology*: Tests for skin sensitivity, rashes, tingling, and prickling related to photosensitivity to electromagnetic fields from lighting, daylight or computer screens. (Dr. Robert Sarkany, Photodermatology Department, St Thomas’s Hospital, London.)
9. *Live blood analysis* may show the formation of rouleaux in red blood films much earlier than in normal

subjects, and without abnormal blood proteins—possibly because the red cells have been slightly damaged, lost their membrane's negative charges and so, instead of remaining separate, clump as rouleaux.

10. *Measurement of micro DC voltages in the body* is a possible future development. Early anecdotal reports indicate a difference between the normal and the ES subject.

*Subjective testing*, often not recognized by orthodox medical practitioners

1. *Applied kinesiology with EMFs as an allergen.*  
Kinesiology uses muscle reaction to allergens<sup>71</sup> and EMFs for EHS diagnosis and therapy.
2. *Subjective provocation to specific frequencies of EMFs.*  
The Miller Technique, based on provocation–neutralization therapies, uses subjective clinical tests with EMFs at the frequency and coherence to which a patient appears sensitive.<sup>72</sup>

## ES SOLUTIONS

There are no easy solutions as ES often appears when health has already been compromised, or is no longer at peak levels.

Rigorous attention to health, using both environmental and nutritional approaches is absolutely crucial.

Minimization and avoidance of EM stimuli is vital to help the organism cope with the stressor load, and use of detectors to identify sources is important.

Sadly, with the relentless rollout, particularly of transmitting radiofrequency (RF) technology (which used to be called microwave, but has been “rebranded” as RF), the environmental load is steadily and rapidly increasing, which will sensitize ever more individuals, and make life ever more unbearable for severely affected people.

Until the professions and health departments take the issue seriously, frankly the future is bleak. The issue facing us with ever more people sensitized by the proliferation of transmissions, let alone the potential burden from chronic disease contribution, is nothing less than disastrous, and is possibly the biggest Public Health challenge ahead.

It is a greater problem than smoking, lead in petrol, asbestos, and hydrogenated vegetable oils put together, and currently ignored except by the “canaries in the coalmine” and a few pioneers.

However, human ingenuity is wonderful, so once there is a drive and impetus to find solutions, they will be found—however they may involve a great deal of education, some considerable courage in public health arenas, and an increased responsibility by all members of the population to attend to health as a concept and as a personal responsibility.

Possible solutions to be found are

- Design of *all* technology with health in mind—rather than with the arrogant presumption of “no

harm, because we are within ICNIRP limits”—see below.

- An initial simple, energy saving solution would be for all WiFi routers, all cordless phones, and all building alarm detectors, to be “off” as a default when not actually in use. Many Gigawatts of power must be used globally to power devices not actually in use. And those living in the house can justifiably ask “Why should I be irradiated with a Class 2b possible carcinogen without my knowledge and against my will?”
- All systems should be wired as a default, not wireless.
- Multiple use of Stetzer filters or similar to reduce dirty electricity.
- Rewiring of networks to prevent excessive use of the ground as the only return.
- An analysis of and attention to all factors that contribute to an individual's health, such as nutritional, sleep quality, environmental, and other.
- Provision of white zones where sensitive individuals can live, thrive and regain health (the area in Virginia, USA, which is radio silent for the purposes of astronomical observation is a haven for many, as are remote areas in some countries).
- “White zones” need to be free of man-made radiation for all schools, hospitals, old people's homes, and about 20%–30% of all housing if 20%–30% of the population are indeed slightly ES.
- Bedrooms and sitting rooms and where people are likely to be stationary for long periods of time need appropriate design of wiring in housing to reduce EM fields, and no HAN or WAN (wireless “smart” meter systems) should be near homes.
- No dwelling should be between another dwelling and the nearest mast, since then the radiation passes straight through the intervening dwelling.

ICNIRP limits, set by a private group sympathetic to wireless industry wishes affiliated group are six minute heating limits, are only thermal and are for the healthy adult male, and not one of the subsections of population more vulnerable, for example, children, the elderly, and those with compromised health and immune systems. It was advised by ICNIRP in 2002 to all governments that these people would need lower limits than those for adult males. It can be seen from the paper above that to take thermal limits as a safety guide for RF transmissions is an outmoded and outdated approach—though possibly with attractions to vested interests. Very different nonthermal biological long-term, low-level limits prevail around the world (USSR 1958 on, India (partial) 2013 on; BioInitiative 2007 and 2012, Seletun 2011, EU and EC, WHO's IARC in 2001 and 2011).

Below is a summary of approaches currently taken to help sufferers, but since the pathology of EHS is not fully understood, there is no single treatment. Thus, as with most environmental pollution the primary treatment is *avoidance of or protection from EMR*.<sup>73</sup>



A. *Principles: parasympathetic restoration after sympathetic arousal*<sup>74–78</sup>

1. *Triple intervention protocols:* (a) Shielding, to prevent EMR-induced cell membrane protective responses; (b) restoring intercellular communication, using neurological rebalancing, ion-channel opening, mitochondrial function enhancement, interstitial cleaning and intracellular detoxification; (c) rebuilding cell membranes with, for example, nutritionals, antioxidants, and supplements.<sup>79</sup> Patient management depends on EMFs (The Safe Wireless Initiative, USA).<sup>80</sup>
2. *Autonomic Response Testing* (ART) based on biofeedback through muscle tone changes using resonance phenomenon along with markers (Dr. Dietrich Klinghardt).<sup>81–83</sup>
3. *Symptomatic therapy:* Polyparametrical diagnosis, electrical unloading and individual medication (Draft standard, the Federal Medical Biophysical Centre, Health Dept., Russia).

B. *Established techniques*

1. *Preliminary procedure: detection and assessment of radiation exposure.*  
The home and work environments are assessed for harmful electromagnetic radiation using appropriate meters.
2. *Avoidance of radiation exposure.*  
Avoidance of EMR is the most effective procedure to prevent EHS worsening.
  - a. *Newly sensitized patients* should aim to avoid all EMR for six weeks after sensitization.
  - b. *Mains electricity* should be switched off at night (Dr. D. Klinghardt).
  - c. *Changes in lifestyle*, for example, ceasing to use a mobile phone, DECT cordless phone, and WiFi. Under disability laws, workers should continue their jobs, helped by shielding a computer from EMR.<sup>84</sup>
  - d. *Moving house* to avoid external radiation, such as nearby phone masts and WiFi, DECT cordless phones, and mobile phones from neighbors. EMF-free communities have been established in Europe and the USA, pending effective EMF environmental pollution control.
3. *Protection with shielding (RF and MW frequencies).*  
Effective protection against RF and MW radiation is difficult without significant expense and inconvenience. It can be almost impossible to shield against extremely low frequency (ELF) frequencies from power lines.
  - a. *Shielding the body* with clothing made with silvered netting can be effective. This

creates a Faraday cage to protect from RF and some EM fields.

- b. *Shielding the home* from external radiation, often with iron-based paint, aluminum foil, window foil or silvered netting, can help reduce regular exposure. Current advice stresses the need for reducing electric and magnetic fields as much as possible in sleeping areas.
4. *Protection or healing with EMR, subsonic longitudinal waves or subtle energy.*  
Some devices claim to work as follows, although there is limited evidence on their efficacy:
  - a. Boosting and amplifying the body's existing endogenous EMR biorhythms.
  - b. Providing "noise" or anti-matter frequencies to mask or block the harmful radiation.
  - c. Producing EMR or subsonic sound waves at frequencies beneficial to the human body.
 Some devices apparently use scalar waves or subtle energy but these can be measured only in their effects.<sup>85–88</sup> EMR-induced changes in water may be significant.<sup>89,90</sup>
5. *Supplements to strengthen the immune system and chelation.*  
Supplements are used where EHS is seen as impaired immunity or deficiency in calcium, melatonin, magnesium or vitamin B. Antioxidants may be ineffective,<sup>91</sup> but garlic may help.<sup>92</sup> Chelation of heavy metals is suggested.<sup>93</sup> Dr. T. Rau, Medical Director of the Paracelsus Clinic in Switzerland, suggested (2009) treating EHS patients with probiotic supplements and removing metal dental fillings with neurotoxic mercury which can act as a radio antenna.<sup>94</sup>
6. *Applied kinesiology, homeopathy, complementary therapies and plants.*  
Some EHS sufferers claim benefit from complementary therapies, such as applied kinesiology; some say homeopathy is beneficial and helps related allergic reactions. Acupuncture may help.<sup>95</sup> Radiation from plants can also provoke a parasympathetic response.<sup>96</sup>
7. *Health oriented group therapy and cognitive behavioral therapy.*  
Health oriented short-term multidisciplinary group intervention gave mixed results.<sup>97</sup> Cognitive behavioral therapy has been suggested,<sup>98</sup> presumably for EMF phobia rather than actual EHS; it may have a placebo effect if the patient feels their condition is being taken seriously.<sup>99</sup> If all symptoms can be alleviated through cognitive therapy, the supposed EHS is unlikely to be biophysical EHS but EMF phobia. Mobile phone use can match perception of risk.<sup>100</sup>

8. *Anecdotal evidence.*

Some case reports have indicated redressing mineral balance, especially with magnesium supplements, amongst others, may be of help. Others suggest that “earthing” is important to them, either barefoot or using earthed mats in bed or in the house. The earth’s surface is at 0 V potential, the top of a tall plant or tree 0 V, and the top of the human head 0 V as well (if one is barefoot on the earth). The ionosphere is at many thousands of volts. However, if one wears insulating rubber shoes, other footwear, sits in a car with rubber tires, and so on, rather than walking barefoot, the

potential when upright is approx 190 V from head to foot. This unresolved tension means that every cell in vertical line through the body is subject to electrical potentials outside the design specification—and may contribute to electrosensitivity as well as inflammation, and may yet be found to be another cause of chronic degenerative illness.<sup>101–107</sup> However, whilst earthing in a rural environment with minimal man-made ground current may help the body with a DC flow, in an urban area the unwanted effect of large AC potentials may ensue, as the ambient AC is several V/m, so the effect may be less beneficial (Table 47.3).

**TABLE 47.3**  
**Exposure Levels and International Limits**

**1. Electric fields—milliVolts/meter: 0.3–300 GHz, microwave (WiFi, mobile phone masts and phones, cordless phones) (peak to peak)**

| Nature             | Biological Response Threshold | Nonthermal, Biological Limit (Burger-Form Proposed) | Nonthermal, Biological Limit (Salzburg Indoors) | Conscious Symptom Threshold (Some EHS) | Conscious Symptom Threshold (30% Gen. Population) | Nonthermal, Biological Limit (Bio-Initiative Indoors) | Nonthermal, Biological Limit (Bio-Initiative Outdoors) | Heating Limit, 6 min Average, (PHE, ICNIRP) |
|--------------------|-------------------------------|---|---|--|---|---|--|---|
| <0.02              | 0.1                           | 2   | 20  | <20                                    | <60   | 194   | 600  | 61,000                                      |
| <b>Volts/meter</b> |                               |   |   |  |   |   |  |   |
| <0.00002           | 0.0001                        | 0.002   | 0.02  | <0.02                                  | <0.06   | 0.19  | 0.6  | *61   |

**2. Electric fields—milliVolts/meter (V/m): 0.3–300 GHz, microwave (peak to peak)**

| Near Transmitter (mV/m)       | Nature (mV/m)          | Some Conscious Reactions (ES) (mV/m) | Nonthermal Biological Limit BiolInit., Coun. Eur. (mV/m) | Heating Limit PHE, ICNIRP mV/m |
|-------------------------------|------------------------|--------------------------------------|--|--------------------------------|
| Mobile phone/Wi-Fi router     | 6000 (6.0 V/m)         |                                      |  | 61,000 (61.0 V/m)              |
| Wi-Fi laptop                  | 1000 (1.0 V/m)         |                                      |  |                                |
| Phone mast                    | 900 (0.9 V/m)          |                                      |  |                                |
| dLAN, at 1.5 m <sup>114</sup> | 40–220 (0.04–0.22 V/m) |                                      |  |                                |
|                               |                        |                                      | <sup>b</sup> 600 (0.6 V/m)                               |                                |
|                               |                        |                                      | <sup>c</sup> 194 (0.19 V/m)                              |                                |
|                               |                        | <20 (0.02 V/m)                       |  |                                |
|                               | 0.02 (0.00002 V/m)     |                                      |  |                                |

**3. Electric fields—milliVolts/meter: 300 kHz–300 MHz, radio frequency (AM, FM, UHF, VHF radio, TV) (peak to peak)**

| Biological Response: Peripheral Nerve Stimulation | <5 miles RF/ TV Transmitter: Brain Tumors | Non-Thermal, Biological Limit (BioInitiative Indoors) | 2 km from AM: Increased Childhood Leukemia | Non-Thermal, Biological Limit (BioInitiative Outdoors) | 3 km from FM, TV, UHF Masts: × 5 Child'd Cancers | AM Exposure Adult Leukemia | Heating Limit, 6 min. av., ICNIRP |
|---|---|---|--|--|--|----------------------------|-----------------------------------|
| 0.6   | ~194                                      | 194   | 870–5500                                   | 614  | 2000   | 2200–4600                  | 28,000                            |
| <b>Volts/meter</b>                                |   |   |  |  |  |                            |                                   |
| 0.0006  | ~0.194                                    | 0.194   | 0.87–5.5                                   | 0.614  | 2  | 2.2–4.6                    | 28                                |

(continued)

**TABLE 47.3 (continued)**  
**Exposure Levels and International Limits**

4. Electric fields—milliVolts/meter (V/m) and dBm (decibels related to mW), by power of transmitter (milliWatts): some wireless smart meters, Wi-Fi routers, laptops (measured levels vary considerably)

| Transmitter Power (milliWatts) |   |            |            |   |                     |
|--------------------------------|---|------------|------------|---|---------------------|
| Distance<br>(meters)           | ZigBee HAN (10 mW; UK, EU)<br>(Inside Home Smart Meter) |            | Laptop     | Mobile Phone WAN;<br>ZigBee HAN (100 mW; USA)<br>(Area Wireless Smart Meter) (Inside Home, USA) |                     |
|                                |   |            |            | Wi-Fi Router  |                     |
|                                | 10 mW Transmitter                                       |            | 25 mW      | *100 mW Transmitter   |                     |
|                                | dBm   | mV/m (V/m) | mV/m (V/m) | minimum, mV/m (V/m)   | maximum, mV/m (V/m) |
| 0                              | −30   | 2000 (2)   | 3000 (3)   | 2000 (2)  | 7000 (7)            |
| 0.5                            | −48   | 40 (0.04)  | 140 (0.14) | 1100 (1.1)  | 4900 (4.9)          |
| 1                              | −51   | 20 (0.02)  | 70 (0.07)  | 700 (0.7)   | 2800 (2.8)          |
| 2                              | −72   | 10 (0.01)  | 30 (0.03)  | 400 (0.4)   | 1500 (1.5)          |
| 5                              | −76   | 4 (0.004)  | 10 (0.01)  | 100 (0.1)   | 700 (0.7)           |
| 10                             | −80   | 2 (0.002)  | 7 (0.007)  | 50 (0.05)   | 400 (0.4)           |
| 20                             | −90   | 1 (0.001)  | 3 (0.003)  | 30 (0.03)   | 200 (0.2)           |
| 50                             |   |            | 2 (0.002)  | 10 (0.01)   | 100 (0.1)           |
| 100                            |   |            |            | 6 (0.006)   | 50 (0.05)           |

5. SAR heating (specific energy absorption rate)—Watts/kilogram: 2.0 W/kg heating averaged for 10 g of tissue for 6 min. for male adult: ICNIRP 1998 & EU. (1.6 W/Kg heating averaged for 1 g of tissue for 6 min. for male adult: USA 1997 & Australia)

| Biological<br>Damage<br>Threshold | Biological<br>Limit:<br>Whole<br>Body | Neuron<br>Death<br>(max. BBB<br>Leakage) | SAR<br>Heating<br>Limit:<br>(Whole<br>Body) | Wi-Fi<br>Laptop<br>at 1 m | Mobile<br>Phone,<br>(Good<br>Reception) | Mobile,<br>Full Power<br><3 cm to<br>Head | SAR<br>Heating<br>Limit:<br>Head | Wi-Fi<br>Laptop on<br>Lap,<br>Access<br>Point | SAR<br>Heating<br>Limit:<br>Limbs |
|-----------------------------------|---------------------------------------|--|---|---------------------------|---|---|----------------------------------|---|-----------------------------------|
|                                   | <sup>f</sup> Long-Term<br>(Seletun)   | <sup>f</sup> (max. BBB<br>Leakage)       |   |                           |   |   |                                  |   |                                   |
| 0.00002                           | 0.00033<br><sup>f</sup> 0.000033      | 0.012<br><sup>f</sup> 0.001              | 0.08  | 0.05–0.11                 | 0.1                                     | 0.12–1.6                                  | 2.0                              | 2.0   | 4.0                               |
| MicroWatts/kilogram               |                                       |  |   |                           |   |   |                                  |   |                                   |
| 20                                | 330<br><sup>f</sup> 33                | 12,000<br><sup>f</sup> 1000              | 80,000                                      | 50,000–<br>110,000        | 100,000                                 | 120,000–<br>1,600,000                     | 2,000,000                        | 2,000,000                                     | 4,000,000                         |

Averages reduce SAR substantially, for example, DECT cordless phone handsets emit 100 bursts of 0.4 ms every second (i.e., 100 Hz) at 250 mW, but averaged: power = 10 mW, transmission rate 2.5%, and SAR 0.008–0.06 W/kg.

A biological limit 50 times below the lowest known damage is 0.0000004 W/kg (0.4  $\mu$ W/kg).

6. Magnetic fields (including time-varying)—nanoTesla: power lines etc. (100 nT = 0.01 microTesla = 1 milliGauss = 100,000 pT)

| Human<br>Sensitivity:<br>Aurora<br>Disturbance<br>(Solar Flare) | Human<br>Brain<br>Entrain-<br>ment:<br>Schumann<br>Resonance | Typical<br>House | Conscious<br>Symptom<br>Threshold<br>(Some EHS) | Nonthermal,<br>Biological Limit<br>(California<br>Education<br>Dept.<br>Proposed) | Nonthermal,<br>Biological<br>Limit<br>(Seletun,<br>Bio-<br>Initiative) | Childhood<br>Leukemia<br>$\times 3^{115}$<br>$\times 3.8^{116}$<br>Ch. Acute<br>Lymphoblastic<br>Leuk. $\times 5$ | Non-<br>Thermal,<br>Biological<br>Limit<br>(Italy<br>(Parts)) | ICNIRP<br>(50 Hz,<br>2010)* <sup>h</sup><br>UK (HPA,<br>DECC, 50 Hz,<br>2012) <sup>117</sup> ** |
|---|--|------------------|---|---|--|---|---|---|
|   |  |                  |   |   |  |   |   |   |
| Rise/fall of<br>0.0004 nT at<br>0.0013 nT                       | 0.05 nT  | 2–12             | Rise/fall of<br>5 nT at 7 nT                    | 10  | 100  | $\geq 100$<br>$>300^*$  | 200   | 200,000*<br>360,000**   |

**TABLE 47.3 (continued)**  
**Exposure Levels and International Limits**

7. Power flux density—microWatts/m squared: (100 microW/m<sup>2</sup> (uW/m<sup>2</sup>) = 0.1 milliW/m<sup>2</sup> = 0.0001 W/m<sup>2</sup> = 0.01 microW/cm<sup>2</sup>  
 = 0.00001 milliW/cm<sup>2</sup> = 10 nanoW/cm<sup>2</sup>)

| Nature<br>(uW/m <sup>2</sup> ) | *Sleep<br>Disorder<br>**ES Symp.<br>***EEG Alt.<br>(uW/m <sup>2</sup> ) | Non-Thermal Biological Limit<br>(uW/m <sup>2</sup> )    | Near Transmitter<br>(uW/m <sup>2</sup> ) | Heating Limit<br>(uW/m <sup>2</sup> )           |
|--------------------------------|---|---|--|---|
|                                |   |   |  | UK 58,000,000                                   |
|                                |   |   |  | ICNIRP, 1800 MHz 9,200,000                      |
|                                |   |   |  | ICNIRP, 900 MHz 4,500,000                       |
|                                |   | Bulgaria, Italy <sup>g</sup> , Paris,<br>Poland, Russia | 100,000                                  | Some mobile phones 2000–1,800,000               |
|                                |   | China outdoors  | 60,000                                   | iPad WiFi 700,000                               |
|                                |   | Switzerland <sup>h</sup>                                | 40,000                                   | Wi-Fi access 0.5 m 87,000                       |
|                                |   | Luxembourg  | 20,000                                   | iPad airplane 30,000                            |
|                                |   | Counc. of Eur., 2011                                    | 1000                                     | Laptop, 0.5 m 22,000                            |
|                                |   | Seletun (or 1700)                                       | 170                                      | Mobile phone mast, 100–10,000–<br>100 m 100,000 |
|                                |   | CEur. (med.) AMA,<br>Kumar <sup>h</sup>                 | 100                                      |   |
|                                |   | Salzburg outdoors 2002                                  | 10                                       |   |
|                                |   | BioIn., 2012, gen. pop.                                 | 6  |   |
|                                |   | BioIn., 2012, sens.,<br>children                        | 3  |   |
|                                | *20   | Salzburg indoors 2002;<br>BUND outdoors 2008            | 1  |   |
|                                | **<1  | Burgerform sleeping                                     | 0.01                                     |   |
|                                | ***0.00001  |   | Mobile phones can<br>work at             | 0.00003   |
| 0.000001 <sup>h</sup>          |   |   |  |   |

8. Voltage transients (“dirty electricity”)—GS units: High frequency (Graham-Stetzer units, measured with a Stetzerizer meter)

| Typical House<br>(Dimmer<br>Switch, TV,<br>Microwave<br>Oven) | Nonthermal,<br>Biological<br>Limit<br>(Fisher <sup>118</sup> ) | Conscious<br>Symptom<br>Threshold<br>(Some EHS) | Nonthermal,<br>Biological<br>Limit<br>(Kazakhstan) | Energy Saving<br>Lights, Compact<br>Fluorescent<br>Lights | MS  | Cancer Risk<br>Increased<br>by 13%<br>after One<br>Year | Cancer Risk<br>Increased<br>by 26%<br>after One<br>Year | Severe Ill<br>Health:<br>Diabetes,<br>Asthma, MS,<br>Cancers |
|---|--|---|--|---|-----|---|---|--|
| 25–50   | 30   | 27–40   | 50   | 15–2000   | 580 | 1000  | >2000   | >2000  |

Source: From Bevington MJ. *Electromagnetic Sensitivity and Electromagnetic HyperSensitivity: A Summary*. Capability Books: Bucks; 2013. With permission.

Note: For most toxins safety limits are usually 50 times lower than the human threshold.

<sup>a</sup> 1,952,000 mV/m (1952 V/m) peaks allowed.

<sup>b</sup> BioInitiative (2007, indoors).

<sup>c</sup> Council of Europe (2011, medium term).

<sup>d</sup> Some 100 mW values come from the Swiss government report *Electrosmog in the Environment* (2005, p. 54).

<sup>e</sup> The Seletun (2010) biological safety limit for long-term exposure is 0.000033 W/kg (33 μW/kg) based on a benchmark for adverse health of 0.0166 W/kg. A biological limit 50 times below the lowest known damage is 0.0000004 W/kg (0.4 μW/kg).

<sup>f</sup> Sensitive areas (schools, hospitals, housing, offices, playgrounds).

<sup>g</sup> 0.00000001 uW/m<sup>2</sup>: altered genetic structure in *E. Coli* (Belyaev, 1996).

<sup>h</sup> ICNIRP (<1 Hz, 2009): 2,000,000,000 uncontrolled; ICNIRP (MRI workers, 2014) 2,000,000,000 change within 3 s.



## CONCLUSION

We conclude that electrosensitivity exists as a very real problem. There is ample biological evidence to enable an understanding of this widespread phenomenon. Recent studies suggest possible genetic links,<sup>108</sup> confirm positive subjective evidence,<sup>109,110</sup> and confirm that voltage-gated calcium channels are an established mechanism for EM effects at non-thermal levels.<sup>111</sup> Problems stemming from the conceptual context explain why even well-intentioned investigators may be tempted to deny, defer, obscure, or otherwise divert truth. It is also noted that there are vested interests at stake. As a result a great deal of EM and RF technology has been developed on the mistaken “presumption of no harm.” Unfortunately, ES not only exists but affects many, many people, the great majority of them undiagnosed (because of lack of medical knowledge) and either expensively investigated or mistreated, or worse still ignored, dismissed or ridiculed. Three case studies are noted, including one of the authors, which may of course incur criticism of bias, but perhaps may achieve an acknowledgement of the use of the human as an instrument of experimentation as well as an honest scientifically trained witness to symptoms. The Austrian Medical Association Guidelines provide a useful tool for the Practitioner.

Until there is a political will to grasp the issue and work upon safety and solutions, the future is bleak for those who already suffer and for those who will soon develop the problem. It is intriguing that the proliferation of widespread EM and RF technology is coincidentally accompanied by an increasing burden of chronic illness. The perfect storm of a public health disaster is slowly unfolding before our eyes, whilst, as a society, we continue to keep our eyes tightly closed and pretend “there isn’t a problem.” World renowned architect Thomas Saunders describes the problems of sick buildings and alludes to the adverse effects of ever increasing quantity of EM and RF fields upon society in “The Boiled Frog Syndrome”<sup>113</sup>—if you put a frog into boiling water, it will jump out—but if you place it in cold water and slowly raise the temperature to boiling point, it stays quietly and allows itself to be boiled alive.

On the bright side, human ingenuity is amazing, and if given the desire and resources can solve any problem, once recognized, scoped, and evaluated.

So perhaps dealing with ES is “not a problem, just a project,” and, as they say in the airline industry, “safety may be expensive—but the cost of a mid-air collision...” Better that approach than a fairy story becoming horribly true...

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