INTRODUCTION TO ORGANIC FARMING

RACHEL NICOLL

ORGANIC FARMING

- ‘Going organic’ is a demanding process for the farmer; it takes a minimum 2 year conversion period for the soil.
- Yields per acre are about 20% lower than from conventionally farmed plots, although fertilizer use is reduced by up to 50% and pesticide use by 97%.
- Organic produce must meet certain standards that prohibit the use of synthetic pesticides, synthetic growth regulators, soluble fertilisers, sewage sludge, antibiotics, growth hormone, bioengineering or ionising radiation. Organic food may, however, still contain bacteria and other pathogens.
- Regulations and further information: www.soilassociation.org.uk

DOES INCREASED DEMAND EQUAL LOWER QUALITY?

- There has been a dramatic increase in the amount of organic farming in the UK, despite the cost, in response to the fears about the increase in chemicals and introduction of GM crops.
- Consequently nearly 80% of organic food is imported, calling into question the standards of the exporting countries.
- The Soil Association and the Organic Farmers and Growers, which are responsible for the regulation of organic food in the UK, admit that monitoring the quality of imports is notoriously difficult.

NUTRITIONAL CONTENT

- A recent meta-analysis based on 67 published studies found that organic meat had significantly higher total and ω3 PUFAs than conventional meat (Srednicka-Tober D, Br J Nutr, 2016).
- The same team investigated milk content and found a similar result for total and ω3 PUFAs (Srednicka-Tober D, Br J Nutr, 2016).
- And they investigated 343 published studies and found that the range of antioxidants was significantly higher in organic food and pesticide residues, including cadmium, were significantly lower (Baranski M, Br J Nutr, 2014).

INTRODUCTION TO ENDOCRINE DISRUPTORS

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WHAT ARE ENDOCRINE DISRUPTORS?

- Endocrine disruptors are chemicals which are structurally and behaviourally similar to endogenous natural hormones and can either mimic natural hormones or interfere with their signalling, thereby transmitting confusing or incorrect messages. They are commonly known as endocrine disrupting chemicals (EDCs).
- EDCs principally interfere either with the interaction between hormones and their receptors or between the receptors and the target organs and cells.
- Other mechanisms include binding hormone transport proteins or other proteins involved in signalling pathways, inhibiting or inducing enzymes, interfering with uptake and export from cells and modifying gene expression.
- Endocrine disruptors defy everything that is known about toxicology, since minute quantities appear to cause large effects out of all proportion to the dose.
- We are mostly dealing with chemicals that mimic endogenous oestrogen, called environmental oestrogens or xenoestrogens.

XENOESTROGENS: NATURAL HISTORY

The effect of EDCs may be weaker or stronger than natural oestrogen.

Natural oestrogens are short-lived and have a specific purpose in the body. Xenoestrogens, however, pose a particularly high risk because:

- **They are not readily broken down by the body or the environment.**
- **They remain intact and active in living organisms and in the environment for many years.**
- **They are lipophilic, so bioaccumulate in the fat and tissues.**

Xenoandrogens can act in the same way. If a xenoandrogen blocks an androgen receptor in a male, there will be a relative increase in oestrogen levels, which can affect sexual and reproductive health.

Endocrine disruptors: European Commission ‘breached law’ 16 December 2015

The European Court of Justice has ruled that the European Commission has not been quick enough in identifying and banning potentially harmful "*endocrine disruptor*" chemicals, the court ruled on Wednesday in a case brought by Sweden.

In May 2014 Sweden brought the case against the Commission, saying its efforts had come to a "complete standstill" and that illnesses caused by the chemicals could be costing hundreds of millions of euros every year.

Describing the Luxembourg-based court's ruling as unprecedented, environmental group ClientEarth said that the chemicals involved affected human reproductive function in both men and women, increased the incidence of breast cancer and caused abnormal growth patterns in children.

COLBORN LIST FOR POTENTIAL ENDOCRINE DISRUPTORS

- **The purpose of the Colborn (TEDX) List is to present the chemicals for which at least one peer-reviewed study has been published. As at Dec 2015, there were 1038 endocrine disruptors on the TEDX List.**

  http://endocrinedisruption.org/

PRINCIPAL SOURCES OF EDCs

POPs	Virtually all persistent organic pollutants are also EDCs
Alkylphenols, their metabolites nonylphenol, octylphenol	As surfactants in pesticides and detergents (domestic in the US and industrial in Europe). Added to some plastics (polystyrene, polyvinylchloride – PVC) to soften them. Found in paints, lubricating oils and farm chemicals. Their use has been scaled down in Europe over the last decade through voluntary industrial measures.
Bisphenol-A (BPA)	In plastic products, fungicides, pesticides, dyes, flame retardants, dental resins. Also found in food and drink packaging and cans, soft drink and water bottles, milk and juice cartons, baby bottles, eyeglass lenses, medical equipment, toys, CDs/DVDs, mobile phones, consumer electronics, household appliances, sports safety equipment, aircraft, vehicles, microwaveable dishes and water supply pipes. BPA easily leaches into food at room temperature but the effect is more pronounced when heated, such as with babies' bottles (Rubin, J Steroid Biochem Mol Biol, 2011).
Polycyclic aromatic hydrocarbons (PAHs)	Created by incineration of industrial plastic waste, such PVC, and domestic burning of biomass fules, smoking and frying food. Found in asphalt, creosote, coal-tar pitch, roofing tar, coal and crude oil. A few are used in pharmaceuticals, plastics, dyes and pesticides.
Parabens (alkyl-hydroxy benzoates)	Preservatives found in toiletries and foods

SOME UNEXPECTED ENDOCRINE DISRUPTORS

- Toxic metals, particularly mercury, arsenic and cadmium
- Butylated hydroxyanisole (BHA): a food additive which acts as an antioxidant in fat-containing foods and in edible fats and oils. It is also a preservative and antioxidant in cosmetics. It is generally added to packaging rather than food but during storage it vaporises and can leach into foods.
- Pesticides: virtually all types of pesticide can be EDCs.
- Pharmaceutical hormones: birth control pills, HRT and growth hormone in animals. They are excreted in urine where they contaminate the water supply and end up back in the food chain.
- Phytoestrogens: covered in Foods as toxins.

WHY ARE EDCs OF PARTICULAR CONCERN

- Damaging effects are found using very low chemical concentrations, which can be completely different from the effects of the same chemical at higher concentrations.
- Consequently, traditional approaches to determining safe exposure levels (for example, chemical risk assessments) do not work with EDCs.
- There are many periods of vulnerability during which exposure to EDCs can be especially harmful, particularly prenatal and early postnatal development. Effects of early life exposure may not manifest until much later in life.
- EDC exposure in one generation may be transmitted to future generations through mechanisms involved in programming of gene activity (epigenetic changes).
- A recent study of over 2500 subjects by the U.S. Centers for Disease Control and Prevention, indicated that 93% of U.S. residents have measurable amounts of BPA in their urine.

ACUTE FOOD-BORNE POISONINGS WITH EDCs

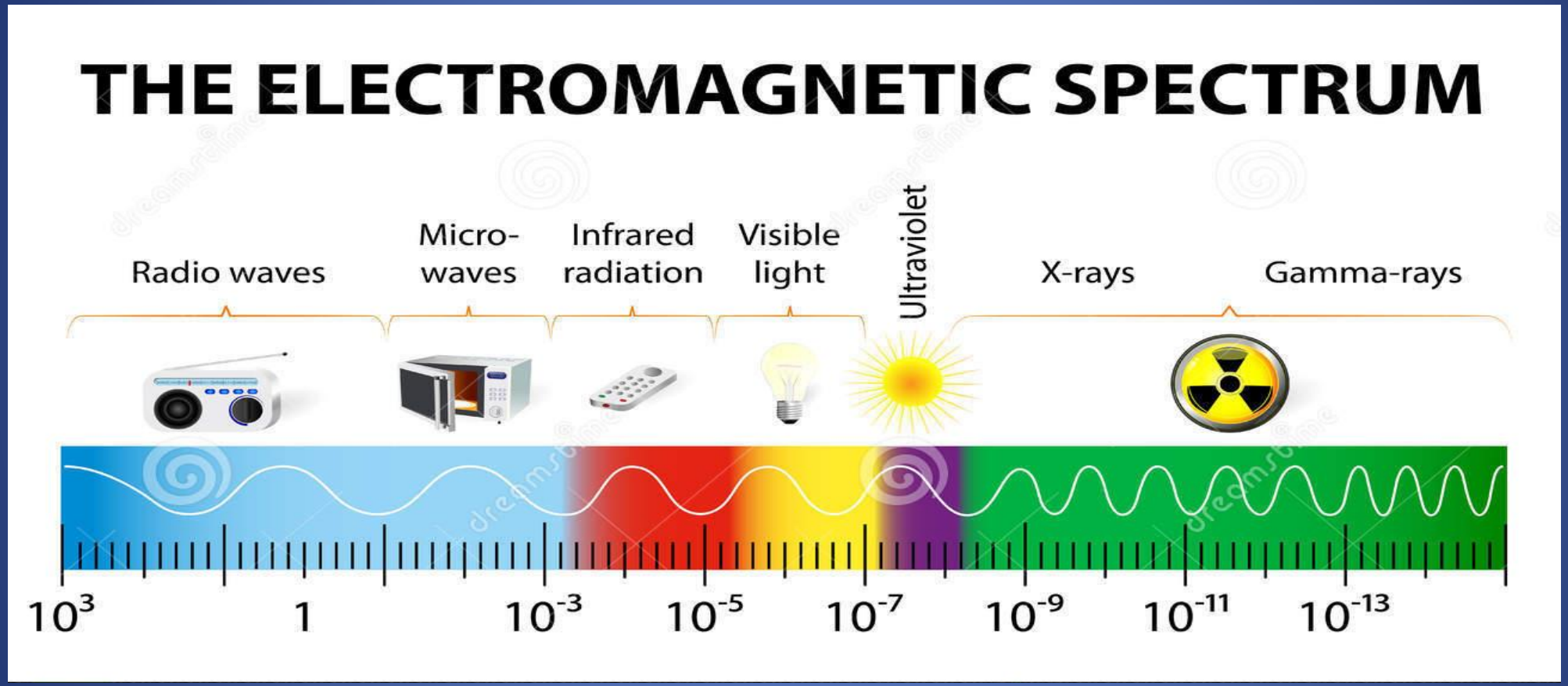
- Japan, 1968: PCBs leaked from heat exchangers to contaminate rice oil used for cooking. In pregnant women, PCBs crossed the placenta, affecting c1,000 babies with mental retardation, developmental delays and liver disease (Masuda, 1985).
- Accidental contamination of the Michigan food chain in the early 1970s with polybrominated biphenyls (PBBs) exposed >4000 individuals. Exposure was associated with girls menstruating around 12 months earlier (Blanck HM, Epidemiology, 2000).
- Another rice oil contamination: Taiwanese women acutely exposed to PCBs and dibenzofurans in 1979 were found to have double the normal rate of abnormal menstrual bleeding and nearly 3 times the risk of delivering a stillborn baby (Yu ML, Int J Epidemiol, 2000). Their teenage sons were a mean 2.7cm shorter than controls and more sexually mature but had reduced sperm motility (Guo YL, Lancet 2000).
- High maternal, but not paternal, consumption of sport fish from a heavily polluted lake was associated with reduced fertility and longer time to conception (Buck G, Epidemiology, 2000).

PRINCIPAL CHRONIC EDC HEALTH EFFECTS

Reproductive toxicity	**Maternal or paternal exposure can result in birth defects, foetal death, altered growth, doubled amount of chromosome aberrations, reduced birth weight, skewed sex ratio and altered age of sexual development. In males: poor semen quality, decreased sperm count and motility, lower serum testosterone. In females: earlier puberty, prolonged time to pregnancy, early menopause. (Sanborn, Cam Fam Physician, 2007; Toft, Reprod Toxicol, 2004; Meeker, Environ Health Perspect, 2011; Gladen, Am J Public Health, 1995; Cooper, Epidemiology, 2002; Buttke, Environ Health Perspect, 2012)**
Exposure *in utero*	**Limb defects in neonates; school age children showed lowered IQ, ADHD, higher aggression, more feminised play among boys; in adults increased cancer risk. (Vreugdenhil, Environ Health Perspect, 2002; Engel, Environ Health Perspect, 2010; Hardell, Environ Health Perspect, 2003)**
Thyroid	**Altered thyroid hormone and thyroid-binding globulin, higher thyroid peroxidase antibodies (Cheek AO, Kow K 1999; Kahn, Environ Health Perspect, 2014; Luo, Int J Environ Health Res, 2014).**
Cancers	**Breast, NHL, prostate, testicular and brain (Ociepa-Zawal, J Env Sci Health, 2010; Schinasi, Int J Environ Res Public Health, 2014; Bassil, Cam Fam Physician, 2007; Ohlson, Chemosphere, 2000).**
Diabetes	**Among Asians and pregnant women (Jaacks, Environ Int, 2015; Longnecker, Diabetes Care, 2001).**

INTRODUCTION TO IONISING RADIATION

RACHEL NICOLL



Non-ionising radiation **Ionising radiation**

IONISING AND NON-IONISING RADIATION

- The electromagnetic (EM) spectrum is divided into ionising and non-ionising radiation, depending upon the extent of the energy carried. The threshold between ionising and non-ionising radiation is located roughly at the upper end of the UV-band, i.e. above 300GHz.
- Ionising radiation comprises high energy particles (photons) which have sufficient energy to break chemical bonds and form ion pairs from the matter through which they pass. This results in removing a negatively charged electron from an atom or molecule, leaving the atom or molecule positively charged.
- Non-ionising radiation energy is too weak to break chemical bonds.

IONISING RADIATION: UNITS OF MEASUREMENT

- The absorbed dose of ionising radiation is measured by the Gray (Gy). 1 Gy is 1 Joule of initial energy demonstrated by the charged particles (ions) released per kg of tissue.
- Because the biological effects per unit of absorbed dose differ with the type of radiation and the part of the body exposed, the Sievert (Sv) is used to measure the weighted effective dose. This will vary according to amount of linear energy transfer (LET).
- Recommended limits on radiation exposure are expressed in Svs.

IONISING RADIATION SOURCES

- Cosmic gamma rays from sun and space:
- Natural terrestrial radiation: radium and radon
- Medical and dental diagnostics and scientific research (X-rays, CT scans etc)
- Medical therapeutics: Radiation (X-ray) therapy for certain cancers
- Radioactive minerals used in building materials, phosphate fertilisers and fuels.
- Screening of luggage and passengers at ports and airports
- Components of TV sets, video display terminals, smoke detectors, luminous watches etc
- Irradiation of food to extend shelf life or destroy disease-causing organisms
- Nuclear power production and nuclear waste
- Occupational exposure among workers in medical and industrial radiography, nuclear reactor construction and operation and uranium mining and enrichment.

HEALTH EFFECTS OF IONISING RADIATION

Because ionising radiation has sufficient energy to remove an electron from an atom, it will directly damage living tissue and its DNA (Umegaki, Sugisawa, Shin. 2001).

There is little dispute that ionising radiation is linked to:

- **Development of cancer** (Umegaki, Ikegami, Inoue, 1994; Boice JD, Blettner M, 1987; Weiss HA, Darby SC 1995)
- **Disruption of thyroid function** (Jereczek-Fossa BA, Alterio D, 2004).
- **Defects in the developing foetus of exposed mothers** (Heiervang KS, 2010)
- **Leukaemia in children of exposed fathers** (Gardner MJ, Snee MP. 1990).

And chromosomal aberrations may continue through successive generations (Morgan WF, 1996).

FOOD IRRADIATION

- Food irradiation uses high-energy radiation: gamma rays, electron beams or x-rays.
- Food irradiation has been approved for some foods in the US to kill pathogenic bacteria, insects and parasites. In the US, irradiated food for sale must be labelled as such but there is no requirement to inform customers that restaurant food has been irradiated.
- Irradiation is being promoted by some international bodies and industry groups as the answer to the growing problem of food poisoning.
- It is also a means to combat world hunger by reducing spoilage and extending food shelf life.
- The World Health Organisation (WHO) has already approved irradiation but has set a maximum dose limit. There are currently proposals to relax these global standards, including the removal of the current dose limit.

FOOD IRRADIATION: COMING TO A SUPERMARKET NEAR YOU?

Limited food irradiation is permitted in the EU and is confined to herbs, spices and vegetable seasonings.

But the European Commission is considering whether to extend this list of permitted foods.

Nevertheless…..

Friday, 23 March, 2001 BBC News

Shops breaking irradiation food laws

A BBC investigation has found evidence that irradiated food is on sale in leading British supermarkets and health food stores, breaking UK and European laws

CONSEQUENCES OF FOOD IRRADIATION (1)

- Loss of nutrients: for example, vitamin E levels can be reduced by 25% after irradiation and vitamin C by 5-10%. This is compounded by the longer storage times of irradiated foods.
- When food is exposed to high doses of ionising radiation, its chemical composition and nutritional content can change, often forming radiolytic by-products. Very few of these chemicals have been adequately tested for toxicity but it is known that high doses of one such chemical (2-DCB) can cause DNA damage in rat colon cells.
- With some bacteria, such as *C. botulinum,* it is the toxin produced by the bacteria, rather than the bacteria itself, which poses the health hazard. If the bacterium has already produced its toxin before irradiation, the toxin is unaffected by the irradiation.

CONSEQUENCES OF FOOD IRRADIATION (2)

- Irradiating foods could mislead consumers into thinking these are safer. There is therefore a risk that consumers will fail to take necessary measures to prevent cross-contamination. The risk of recontamination of food after irradiation is very serious as a near sterile food is an ideal medium for very rapid growth of re-introduced bacteria. Irradiated food must therefore be handled with even greater care in homes and restaurants.
- Irradiation can cause mutations in bacteria and viruses leading to potentially resistant strains.
- Extension of the EU list of foods permitted for irradiation could mean that in future a significant part of the diet of consumers will consist of irradiated foods. The long-term impacts of this to health remain unknown. Far more research is required prior to exposing populations to such a diet.
- More information: www.foodcomm.org.uk/campaigns/irradiation_concerns/

INTRODUCTION TO NON-IONISING RADIATION

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SOURCES OF NON-IONISING RADIATION

Non-ionising radiation comprises 2 principal sources:

- Microwave (MW) and radiofrequency radiation (RFR): Radio and TV transmitters, satellite telecommunications systems, microwave ovens, mobile phones, mobile phone masts, radar
- Extremely low frequency (ELF) magnetic fields: Solar activity and thunderstorms, electric power production, transmission, distribution and use (i.e. power lines, electrical wiring, transformers, motors, household appliances, video display terminals and medical devices including MRI scanners.

DIFFERENCES BETWEEN ELECTRIC AND MAGNETIC FIELDS

- Electromagnetic fields (EMFs) are made up of both electrical and magnetic fields. At higher frequencies the electrical and magnetic fields are inseparable but at extremely low frequencies (ELFs), electrical and magnetic frequencies are independent and measured separately.
- Both fields are produced whenever current is flowing through a wire. But when a device is merely plugged in but not switched on, it is still generating an electric field.
- Most obstacles such as walls and fences can shield us from electrical fields but nothing can shield us from magnetic fields, which can penetrate anything except lead.
- Any device with an electric motor can be a source of a magnetic field; magnetic fields produced by household appliances can be far in excess of those found under electric power transmission lines.

NON-IONISING RADIATION: DOES IT AFFECT HEALTH?

- Orthodox medicine and science believe that because the ELF fields have a long wavelength, similar to the earth's radius, they will pass through the body without depositing any energy.
- With respect to RF fields, they have a much shorter wavelengths and so some energy may be deposited in the body but the only effect it would have is heating.
- Therefore, provided there is no heating effect, there are no health effects.

Mobile phones 'appear to be safe' (BBC News, January 2004)

UK government scientists have given a cautious thumbs up to mobile phones and transmission masts.

NON-IONISING RADIATION: NON-THERMAL HEALTH EFFECTS

- Unfortunately, individual experience suggests there are non-thermal health consequences:
- We are dealing with 2 potential effects:
  - Non-thermal health effects
  - Development of electrosensitivity
- The problem is that given the small amount of energy that is deposited in the body with ELF fields, any health effects would have to be produced by an as yet unknown biophysical mechanism (Ahlbom A 2000).
- But that doesn't mean this mechanism does not exist.
- We still don't know exactly how a flashing light can induce seizures in epileptics but there is no doubt that it occurs.

HUMAN STUDIES SHOWING HEALTH EFFECTS although there are plenty showing none

- **Childhood leukaemia; leukaemia through occupational exposure; genetic damage; proliferation of breast cancer cells through blocking melatonin production** (Ahlbom A, 2000; Miller AB Am J Epidemiol 1996; Chen G, Environ Health Perspect 2000 Liburdy RP, J Pineal Res 1993).
- **Arrhythmia, heartrate variability and MI mortality** (Savitz DA 1999; Sastre A 1998).
- **Neuroexcitotoxicity and cardiac fibrillation; altered neurotransmitters and BBB penetration** (Tenforde T, 1992; Winkler T, Neuroscience 1995).

ELECTROSENSITIVITY

- Electrosensitivity is a condition similar to multiple chemical sensitivity, and often co-existing with it, in which even a small exposure to electric or magnetic fields can generate a range of symptoms; those with existing nervous system damage may be more susceptible (Persinger M, Percept Motor Skills, 1973).
- This condition is generally not recognised by orthodox medicine or science.
- WHO Factsheet 296, 2005 defines Electrosensitivity as: 'a variety of non-specific symptoms, which afflicted individuals attribute to exposure to electromagnetic fields'.

ELECTROSENSTIVITY SYMPTOMS

Common symptoms:

- Skin: itch, rash, flushing, burning, tingling
- Confusion, memory loss, poor concentration
- Fatigue/weakness
- Headache
- Chest pain, heart problems
- Mood swings.

Other symptoms:

- Nausea
- Panic attacks
- Insomnia
- Seizures
- Ear pain/ringing in the ears
- Feeling of vibration
- Paralysis
- Dizziness

ELECTROSENSITIVITY (ES) SUSCEPTIBILITY

- ES is particularly associated with office work; EMFs may contribute to the problems of sick building syndrome.
- Other stressors may make one more prone to develop ES. Those suffering from CFS or heavy metal toxicity are particularly at risk. ES commonly occurs alongside MCS and the one may set off the other (Smith CW, Clin Ecol 1986).
- Because the nervous system is the primary target for chemicals and EMFs, those with nervous system damage, such as MS patients, may be more susceptible to ES (Persinger M, Percept Motor Skills, 1973).
- Overexposure to EMFs can also exacerbate existing health problems and may prevent recovery. There is evidence that those in intensive care units may be exposed to high EMFs which are slowing recovery (Petrucci M, Intensive Care Med, 1999).
- Avoidance is almost impossible in the modern world.

WHY MIGHT ELECTROMAGNETIC RADIATION CAUSE NON-THERMAL HEALTH EFFECTS?

- Because our bodies are electrical it is reasonable that external electrical forces may interfere with our electrical system.
- EM signals in the microwave and radiofrequency range (such as mobile phones) are very close to those used by the body to organise cellular activity and metabolism.
- Some of the frequencies used in mobile phones correspond to frequencies found in the human brain, specifically delta waves, which relate to sleep, and alpha waves, which signify a calm and relaxed state.

A PROPHET OF DOOM OR AHEAD OF HIS TIME?

'The greatest polluting element in the earth's environment is the proliferation of electromagnetic fields. I consider that to be a far greater threat on a global scale than warming or the increase of chemical elements in the environment' (Robert O Becker, The Body Electric, 1985).

ELECTROMAGNETIC RADIATION AND HEALTH:
EVIDENCE, DIAGNOSIS AND MANAGEMENT

Scientific conference on electrosensitivity and the health effects of electromagnetic radiation

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SUMMARY AND CONCLUSION

KEY POINTS FROM THE DAY

- It's not one toxin that does that damage but the relentless build-up of all toxins that we are exposed to on a daily basis throughout our lives.
- We can't trust that foods and products on the market are safe.
- We can have a fair degree of confidence that our water contains few pathogenic organisms but it will not be free of other toxins.
- Babies and infants are at more risk than adults and have fewer defences.

MECHANISMS SUGGEST THE SOLUTION

- Most studies fail to investigate a mechanism between toxins and health problems, particularly in humans.
- In animals, however, the mechanism is fairly consistently the generation of ROS by toxins.
- Animal studies that investigate protection against toxin-induced disease fairly consistently show that antioxidants are protective.
- Animal studies that investigate remedies for toxin-induced disease fairly consistently show that antioxidants are effective.
- Very few studies have investigated detoxification ability.

PREVENTION IS SO MUCH EASIER THAN CURE!

- Avoid toxin exposure where possible: buy organic food, invest in a ‘whole house’ water filter, buy low chemical cosmetics, toothpaste, cleaning products, paints etc, find a ‘mercury-free’ dentist and don’t accept any metal in the mouth. Avoid vaccination unless absolutely necessary and detox afterwards.
- Avoid air conditioned buildings where the windows cannot be opened. In a house with new building work, decoration, furniture or furnishings, ensure off-gassing is complete before closing windows.
- Use wired broadband instead of wifi; protect bedroom with anti-radiation paint.
- Ensure immune and detoxification systems are optimised.
- Ensure microbiota are optimised and the gut contains nothing pathogenic; treat intestinal permeability.

OTHER SOLUTIONS

- Eat real food, nothing processed.
- Forget 5-a-day: we need to be eating 7-a-day
- Supplement antioxidants
- Test co-factors for detoxification and supplement as necessary, particularly L-methionine, glutathione.
- Useful labs: Genova (gdx.net) and Biolab (biolab.co.uk)
- Biolab can access the new Great Plains test for 168 toxic chemicals (greatplainslaboratory.com).

USEFUL RESOURCES

- **Websites:**

  healthy-house.co.uk; emfields.com; freshwaterfilter.com.
- **Consider joining the British Society for Ecological Medicine (bsem.org.uk): useful resource and good conferences.**
- **If you want to buy just one book, buy 'Living Dangerously' by Pat Thomas. Available on Amazon.**
- **Biolab and Genova have a lot of useful information about toxins on their websites.**

AND FINALLY…

- It's not just conventional doctors who adhere to the 'magic bullet' concept of treatment – most patients do too.
- And the public wants to believe they are only minimally exposed to toxins: 'Surely they wouldn't let us be poisoned?'
- So education of the public with some hard evidence comprising facts and figures is imperative.
- Policy change will only come about through 'people power', so become activists yourselves and encourage your clients to become activists as well.