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Abdel-Rassoul, G., et al. (2007). "Neurobehavioral effects among inhabitants around mobile phone base stations." Neurotoxicology **28**(2): 434-440.

> BACKGROUND: There is a general concern on the possible hazardous health effects of exposure to radiofrequency electromagnetic radiations (RFR) emitted from mobile phone base station antennas on the human nervous system. AIM: To identify the possible neurobehavioral deficits among inhabitants living nearby mobile phone base stations. METHODS: A cross-sectional study was conducted on (85) inhabitants living nearby the first mobile phone station antenna in Menoufiya governorate, Egypt, 37 are living in a building under the station antenna while 48 opposite the station. A control group (80) participants were matched with the exposed for age, sex, occupation and educational level. All participants completed a structured questionnaire containing: personal, educational and medical histories; general and neurological examinations; neurobehavioral test battery (NBTB) [involving tests for visuomotor speed, problem solving, attention and memory]; in addition to Eysenck personality questionnaire (EPQ). RESULTS: The prevalence of neuropsychiatric complaints as headache (23.5%), memory changes (28.2%), dizziness (18.8%), tremors (9.4%), depressive symptoms (21.7%), and sleep disturbance (23.5%) were significantly higher among exposed inhabitants than controls: (10%), (5%), (5%), (0%), (8.8%) and (10%), respectively ($P<0.05$). The NBTB indicated that the exposed inhabitants exhibited a significantly lower performance than controls in one of the tests of attention and short-term auditory memory [Paced Auditory Serial Addition Test (PASAT)]. Also, the inhabitants opposite the station exhibited a lower performance in the problem solving test (block design) than those under the station. All inhabitants exhibited a better performance in the two tests of visuomotor speed (Digit symbol and Trailmaking B) and one test of attention (Trailmaking A) than controls. The last available measures of RFR emitted from the first mobile phone base station antennas in Menoufiya governorate were less than the allowable standard level. CONCLUSIONS AND RECOMMENDATIONS: Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions either by facilitation or inhibition. So, revision of standard guidelines for public exposure to RER from mobile phone base station antennas and using of NBTB for regular assessment and early detection of biological effects among inhabitants around the stations are recommended.

Adair, R. (2002). "Vibrational resonances in biological systems at microwave frequencies." Biophysical journal **82**(3): 1147-1152.

> Many biological systems can be expected to exhibit resonance behavior involving the mechanical vibration of system elements. The natural frequencies of such resonances will, generally, be in the microwave frequency range. Some of these systems will be coupled to the electromagnetic field by the charge distributions they carry, thus admitting the possibility that microwave exposures may generate physiological effects in man and other species. However, such microwave excitable resonances are expected to be strongly damped by interaction with their aqueous biological environment. Although those dissipation mechanisms have been studied, the limitations on energy transfers that follow from the limited coupling of these resonances to the electromagnetic field have not generally been considered. We show that this coupling must generally be very small and thus the absorbed energy is so strongly limited that such resonances cannot affect biology significantly even if the systems are much less strongly damped than expected from basic dissipation models.

Adair, R. K. (1991). "Biological effects on the cellular level of electric field pulses." Health Physics **61**(3): 395-399.

> Analysis of electric and magnetic fields in the human body generated upon exposure to external pulsed electric fields are used to consider possible biological effects at the cellular level. For peak external field strengths as high as 100 kV m-1, the effects of the consequent internal electric

fields on sensitive cell elements, such as the membranes, organelles, and the macromolecules that carry genetic information, are shown to be small compared with the normal thermal agitation of the elements. Hence, based on the description of the cell and the analysis presented here, such pulses cannot be expected to produce any biological effects at the cellular level.

Adair, R. K. (1991). "Constraints on biological effects of weak extremely-low-frequency electromagnetic fields." Physical review. A **43**(2): 1039-1048.

Ahlbom, A., et al. (1993). "Electromagnetic fields and childhood cancer." Lancet **342**(8882): 1295-1296.

Aizen, M. and L. Harder (2009). "The global stock of domesticated honey bees is growing slower than agricultural demand for pollination." Current Biology **19**(11): 915-918.

The prospect that a global pollination crisis currently threatens agricultural productivity has drawn intense recent interest among scientists, politicians, and the general public [1], [2], [3], [4] and [5]. To date, evidence for a global crisis has been drawn from regional or local declines in pollinators themselves [6], [7], [8] and [9] or insufficient pollination for particular crops [9] and [10]. In contrast, our analysis of Food and Agriculture Organization (FAO) [11] data reveals that the global population of managed honey-bee hives has increased 45% during the last half century and suggests that economic~ globalization, rather than biological factors, drives both the dynamics of the global managed honey-bee population and increasing demands for agricultural pollination services [12]. Nevertheless, available data also reveal a much more rapid (>300%) increase in the fraction of agriculture that depends on animal pollination during the last half century, which may be stressing global pollination capacity. Although the primary cause of the accelerating increase of the pollinator dependence of commercial agriculture seems to be economic and political and not biological, the rapid expansion of cultivation of many pollinator-dependent crops has the potential to trigger future pollination problems for both these crops and native species in neighboring areas. Such environmental costs merit consideration during the development of agriculture and conservation policies.

Akan, Z., et al. (2010). "Extremely low frequency electromagnetic fields affect the immune response of monocyte derived macrophages to pathogens." Bioelectromagnetics.

This study aimed to determine the effect of extremely low-frequency electromagnetic fields (ELF-EMF) on the physiological response of phagocytes to an infectious agent. THP-1 cells (human monocytic leukemia cell line) were cultured and 50 Hz, 1 mT EMF was applied for 4-6 h to cells induced with Staphylococcus aureus or interferon gamma/lipopolysaccharide (IFγ/LPS). Alterations in nitric oxide (NO), inducible nitric oxide synthase (iNOS) levels, heat shock protein 70 levels (hsp70), cGMP levels, caspase-9 activation, and the growth rate of S. aureus were determined. The growth curve of exposed bacteria was lower than the control. Field application increased NO levels. The increase was more prominent for S. aureus-induced cells and appeared earlier than the increase in cells without field application. However, a slight decrease was observed in iNOS levels. Increased cGMP levels in response to field application were closely correlated with increased NO levels. ELF-EMF alone caused increased hsp70 levels in a time-dependent manner. When cells were induced with S. aureus or IFγ/LPS, field application produced higher levels of hsp70. ELF-EMF suppressed caspase-9 activation by a small extent. These data confirm that ELF-EMF affects bacterial growth and the response of the immune system to bacterial challenges, suggesting that ELF-EMF could be exploited for beneficial uses.

Alberts B., B. D., Lewis J., Raff M, Roberts K., Watson J.D. (1994). Molecular Biology of the Cell. N.Y., USA., Garland Publishing, Inc.

Albrecht, U. (2012). "Timing to perfection: the biology of central and peripheral circadian clocks." Neuron **74**(2): 246-260.

The mammalian circadian system, which is comprised of multiple cellular clocks located in the organs and tissues, orchestrates their regulation in a hierarchical manner throughout the 24 hr of the day. At the top of the hierarchy are the suprachiasmatic nuclei, which synchronize subordinate organ and tissue clocks using electrical, endocrine, and metabolic signaling

pathways that impact the molecular mechanisms of cellular clocks. The interplay between the central neural and peripheral tissue clocks is not fully understood and remains a major challenge in determining how neurological and metabolic homeostasis is achieved across the sleep-wake cycle. Disturbances in the communication between the plethora of body clocks can desynchronize the circadian system, which is believed to contribute to the development of diseases such as obesity and neuropsychiatric disorders. This review will highlight the relationship between clocks and metabolism, and describe how cues such as light, food, and reward mediate entrainment of the circadian system.

Aldinucci, C., et al. (2000). "The effect of pulsed electromagnetic fields on the physiologic behaviour of a human astrocytoma cell line." Biochimica et Biophysica Acta (BBA)-Molecular Cell Research **1499**(1-2): 101-108.

Apel, K. and H. Hirt (2004). "Reactive oxygen species: metabolism, oxidative stress, and signal transduction." Annu. Rev. Plant Biol. **55**: 373-399.

Several reactive oxygen species (ROS) are continuously produced in plants as byproducts of aerobic metabolism. Depending on the nature of the ROS species, some are highly toxic and rapidly detoxified by various cellular enzymatic and nonenzymatic mechanisms. Whereas plants are surfeited with mechanisms to combat increased ROS levels during abiotic stress conditions, in other circumstances plants appear to purposefully generate ROS as signaling molecules to control various processes including pathogen defense, programmed cell death, and stomatal behavior. This review describes the mechanisms of ROS generation and removal in plants during development and under biotic and abiotic stress conditions. New insights into the complexity and roles that ROS play in plants have come from genetic analyses of ROS detoxifying and signaling mutants. Considering recent ROS-induced genome-wide expression analyses, the possible functions and mechanisms for ROS sensing and signaling in plants are compared with those in animals and yeast

Avcı, B., Akar, A., Bilgici, B., Tunçel, O.K. (2012). "Oxidative stress induced by 1.8 Ghz radio frequency electromagnetic radiation and effects of the garlic extract in rats." Int J Radiat Biol. .

Abstract Purpose: We aimed to study the oxidative damage induced by radiofrequency electromagnetic radiation (RF-EMR) emitted by mobile telephones and the protective effect of garlic extract used as an anti-oxidant against this damage. Materials and methods: A total of 66 albino Wistar rats were divided into 3 groups. The 1(st) group of rats was given 1.8 GHz, 0.4 W/kg specific absorption rate (SAR) for 1 hour a day for 3 weeks. The 2(nd) group was given 500 mg/kg garlic extract in addition to RF-EMR. The 3(rd) group of rats was used as the control group. At the end of the study, blood and brain tissue samples were collected from the rats. Results: After the RF-EMR exposed, the advanced oxidation protein product (AOPP) levels of brain tissue increased compared with the control group ($p<0.001$). Garlic administration accompanying the RF-EMR, on the other hand, significantly reduced AOPP levels in brain tissue ($p<0.001$). The serum nitric oxide (NO) levels significantly increased both in the 1(st) and the 2(nd) group ($p<0.001$). However, in the group for which garlic administration accompanied that of RF-EMR, there was no difference in serum NO levels compared with the RF-EMR exposed group ($p>0.05$). There was no significant difference among the groups with respect to malondialdehyde (MDA) levels in brain tissue and blood samples ($p>0.05$). Similarly, no difference was detected among the groups regarding serum paroxonase (PON) levels ($p>0.05$). We did not detect any PON levels in the brain tissue. Conclusions: The exposure of RF-EMR similar to 1.8 GHz Global system for mobile communication (GSM) leads to protein oxidation in brain tissue and an increase in serum NO. We observed that garlic administration reduced protein oxidation in brain tissue and that it did not have any effects on serum NO levels.

Avendano, C., et al. (2011). "Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation." Fertility and sterility.

Objective :To evaluate the effects of laptop computers connected to local area networks wirelessly (Wi-Fi) on human spermatozoa.
Design:Prospective in vitro study. Setting

Center for reproductive medicine. Patient(s): Semen samples from 29 healthy donors. Intervention(s)
Motile sperm were selected by swim up. Each sperm suspension was divided into two aliquots. One sperm aliquot (experimental) from each patient was exposed to an internet-connected laptop by Wi-Fi for 4 hours, whereas the second aliquot (unexposed) was used as control, incubated under identical conditions without being exposed to the laptop. Main Outcome Measure(s)
Evaluation of sperm motility, viability, and DNA fragmentation.
Result(s): Donor sperm samples, mostly normozoospermic, exposed ex vivo during 4 hours to a wireless internet-connected laptop showed a significant decrease in progressive sperm motility and an increase in sperm DNA fragmentation. Levels of dead sperm showed no significant differences between the two groups.
Conclusion(s): To our knowledge, this is the first study to evaluate the direct impact of laptop use on human spermatozoa. Ex vivo exposure of human spermatozoa to a wireless internet-connected laptop decreased motility and induced DNA fragmentation by a nonthermal effect. We speculate that keeping a laptop connected wirelessly to the internet on the lap near the testes may result in decreased male fertility. Further in vitro and in vivo studies are needed to prove this contention.

Balmori, A. and O. Hallberg (2007). "The urban decline of the house sparrow (Passer domesticus): a possible link with electromagnetic radiation." Electromagn Biol Med **26**(2): 141-151.

During recent decades, there has been a marked decline of the house sparrow (Passer domesticus) population in the United Kingdom and in several western European countries. The aims of this study were to determine whether the population is also declining in Spain and to evaluate the hypothesis that electromagnetic radiation (microwaves) from phone antennae is correlated with the decline in the sparrow population. Between October 2002 and May 2006, point transect sampling was performed at 30 points during 40 visits to Valladolid, Spain. At each point, we carried out counts of sparrows and measured the mean electric field strength (radiofrequencies and microwaves: 1 MHz-3 GHz range). Significant declines (P = 0.0037) were observed in the mean bird density over time, and significantly low bird density was observed in areas with high electric field strength. The logarithmic regression of the mean bird density vs. field strength groups (considering field strength in 0.1 V/m increments) was R =-0.87 (P = 0.0001). The results of this article support the hypothesis that electromagnetic signals are associated with the observed decline in the sparrow population. We conclude that electromagnetic pollution may be responsible, either by itself or in combination with other factors, for the observed decline of the species in European cities during recent years. The appearently strong dependence between bird density and field strength according to this work could be used for a more controlled study to test the hypothesis.

Banks, S. and D. F. Dinges (2007). "Behavioral and physiological consequences of sleep restriction." Journal of clinical sleep medicine: JCSM: official publication of the American Academy of Sleep Medicine **3**(5): 519.

Barnham, K. J., et al. (2004). "Neurodegenerative diseases and oxidative stress." Nature Reviews Drug Discovery **3**(3): 205-214.

Oxidative stress has been implicated in the progression of Alzheimer's disease, Parkinson's disease and amyotrophic lateral sclerosis. Oxygen is vital for life but is also potentially dangerous, and a complex system of checks and balances exists for utilizing this essential element. Oxidative stress is the result of an imbalance in pro-oxidant/antioxidant homeostasis that leads to the generation of toxic reactive oxygen species. The systems in place to cope with the biochemistry of oxygen are complex, and many questions about the mechanisms of oxygen regulation remain unanswered. However, this same complexity provides a number of therapeutic targets, and different strategies, including novel metal–protein attenuating compounds, aimed at a variety of targets have shown promise in clinical studies.

Bassett, C. A. L., Pawluk, R.J., Becker, R.O. (1964). "Effect of electric currents on bone in vivo." Nature **204**: 652-654.

Baylin, S. B. and J. G. Herman (2000). "DNA hypermethylation in tumorigenesis: epigenetics joins genetics." Trends in Genetics **16**(4): 168-174.

Beebe, S. J., et al. (2003). "Diverse effects of nanosecond pulsed electric fields on cells and tissues." DNA and cell biology **22**(12): 785-796.

Belyaev, I. (2011). "Toxicity and SOS-response to ELF magnetic fields and nalidixic acid in E. coli cells." Mutation Research/Genetic Toxicology and Environmental Mutagenesis.

> Extremely low frequency (ELF) magnetic fields have previously been shown to affect conformation of chromatin and cell proliferation. Possible genotoxic and carcinogenic effects of ELF have also been discussed and tested. In this study, we analyzed the effect of ELF on chromatin conformation in E. coli GE499 cells by the anomalous viscosity time dependence (AVTD) technique. Possible genotoxic ELF effects at the specific combination of static and ELF magnetic fields, that has been proven to have effects on chromatin conformation, were investigated by clonogenic assay, cell growth kinetics, and analysis of SOS-response using inducible recA-lacZ fusion and the β-galactosidase assay. Genotoxic agent nalidixic acid (NAL) was used as positive control and in combination with ELF. Nalidixic acid at 3-30 μg/ml decreased the AVTD peaks and induced cytotoxic effect. In contrast to NAL, ELF increased AVTD, stimulated cell growth, and increased cloning efficiency. These effects depended on frequency within the frequency range of 7-11Hz. While NAL induced SOS response, ELF exposure did not induce the recA-lacZ fusion. Exposure to ELF did not modify the genotoxic effects of NAL either. All together, the data show that ELF, under specific conditions of exposure, acted as nontoxic but cell growth stimulating agent.

Bird, A. (2002). "DNA methylation patterns and epigenetic memory." Genes & development **16**(1): 6-21.

Borgens, R. B., Blight, A.R., Murphy, D.J., Stewart, L. (1986). "Transected Dorsal Column Axons Within the Guinea Pig Spinal Cord Regenerate in the Presence of an Applied Electric Field." Journal of Comparative Neurology **250**: 168-180.

Borgens, R. B. (1988). Stimulation of neuronal regeneration and development by steady electrical fields. New York., Raven Press.

Borgens, R. B., et al. (1986). "Axonal regeneration in spinal cord injury: a perspective and new technique." The Journal of comparative neurology **250**(2): 157-167.

> A set of techniques is described for determining the response of mammalian spinal axons to transection. The logical selection and the advantages of these techniques are discussed. The dorsal column of guinea pig thoracic spinal cord was transected with a tungsten needle and the position of the lesion was marked by a staple-shaped wire device (Foerster: J. Comp. Neurol. 210:335-356, '82). The morphology of dorsal column axons projecting rostrally toward the lesion was examined between 1 and 50 days postlesion by anterograde staining with horseradish peroxidase, applied to a second lesion of the dorsal column two to three vertebral segments caudal to the first. Axons damaged by the original lesion were found to die back 1-2 mm from the plane of transection and at 18-20 hours were characterized by terminal club-shaped swellings attached to the proximal axon by a thin connection. At 50 days postlesion there was some evidence of limited regenerative responses in terms of growth-cone-like axon terminals, and the presence of aberrant axonal branching, but no evidence of regenerating axons approaching close to the plane of transection. These findings are in agreement with previous studies indicating little or no effective regrowth of myelinated axons in the mammalian spinal cord. These same techniques were used in a succeeding study to examine the effects of applied electric fields on the axonal response to transection.

Brighton C.T., F. Z. B., Black J., (1979). Evaluation of the use of constant direct current in the treatment of non-union. New York, Plenum Press.

Brighton, C. T., McClusky, W.P. (1987). " Response of cultured bone cells to capacitively coupled electrical field: Inhibition of cAMP response to parathyroid hormone." J. Orthop. Res. **6**: 567-571.

Brighton, C. T., Townsend, P.F. (1988). "Increased c-AMP production after short-term capacitively coupled stimulation in bovine growth plate chondrocytes." J. Orthop. Res. **6**: 552-558.

Brighton, C. T., Jensen, L., Pollack, S.R., Tolin,B.S., Clark,C.C., (1989). ""Proliferative and synthetic response of bovine growth plate chondrocytes to various capacitively coupled electrical fields"." J. Orthop. Res. **7**: 759-765.

Carlo, G. (1998). Wireless Phones and Health: Scientific Progress. . Boston MA, , Kluwer Academic Publishers.

Carlo, G. L. (2008). "Illusion and Escape: The Cell Phone Disease Quagmire."

Carlo, G. L. and R. S. Jenrow (2000). "Scientific progress - wireless phones and brain cancer: current state of the science." MedGenMed : Medscape general medicine **2**(3): E40.

CONTEXT: The current science is not definitive about health risks from wireless phones; however, the legitimate questions about safety that have arisen from recent studies make claims of absolute safety no longer supportable. OBJECTIVE: The objective of this paper is to outline for primary care providers the results of the most current research on the possible impact of wireless phone use on human health. Presented are study results from Wireless Technology Research (WTR) program, the 7-year, $27 million effort funded by the wireless industry in the United States, that represents the world's most comprehensive research effort addressing this issue to date. Science-based recommendations for consumer interventions and future research are presented. DATA SOURCES: Original studies performed under the WTR program as well as other relevant research from around the world. STUDY SELECTION: This article presents a synopsis of the peer-reviewed in vitro and in vivo laboratory research, and the peer-reviewed epidemiology studies supported by the WTR, as well as a summary of other relevant work. DATA EXTRACTION: Only peer-reviewed scientific studies are presented, primarily WTR-sponsored research. In addition, results of the WTR literature surveillance program, which identified other relevant toxicology and epidemiology studies on an ongoing basis, are presented. These studies are presented in the context of their usefulness in providing intervention recommendations for consumers. DATA SYNTHESIS: Following a qualitative synthesis of specific relevant non-WTR research and a critical assessment of the WTR results, the following represents the current state of scientific understanding relevant to the public health impact of wireless phones: laboratory studies appear to have confirmed that radio frequency radiation from wireless phone antennas is insufficient to cause DNA breakage; however, this same radiation appears to cause genetic damage in human blood as measured through the formation of micronuclei. An increase in the rate of brain cancer mortality among hand-held cellular phone users as compared to car phone users, though not statistically significant, was observed in the WTR cohort study. A statistically significant increase in the risk of neuro-epithelial brain tumors was observed among cellular phone users in another case-control study. CONCLUSIONS: As new data emerge, our understanding of this complex problem will improve; however, at present there is a critical need for ongoing and open evaluation of the public health impact of new science, and communication of this science and derivative intervention options to those who are potentially affected.

Carlo, G. L., et al. (2002). "Scientific Progress."

Carlo, G. T., PG. (2001). Wireless Phones and Health: State of the Science. . Boston MA, Kluwer Academic Publishers.

Cleary, S. F., et al. (1988). "Modulation of tendon fibroplasia by exogenous electric currents." Bioelectromagnetics **9**(2): 183-194.

A chicken tendon explant model system has been developed to investigate the effects of extremely-low-frequency (ELF), low-amplitude, unipolar, square wave pulsed electric fields on fibroplasia in vitro. An electric field parameter set consisting of 1-Hz, 1-ms duration pulses, with a time-averaged current density of 7 mA/m2 (peak current density 7 A/m2) induced maximal (32%) increase in fibroblast proliferation in tendon explants exposed for 4 days. Exposure to the same field at an average current density of 1.8 mA/m2 had no effect on fibroblast proliferation,

whereas exposure to current densities on greater than 10 mA/m2 inhibited proliferation and relative collagen synthesis, without affecting noncollagen protein synthesis. Fibroplasia was significantly increased in explants oriented parallel to applied electric fields having current densities of 3.5 or 7 mA/m2, but there was no detectable effect on explants oriented perpendicular to the same electric field. Fibroblast proliferation and relative collagen synthesis were inversely proportional to donor age for chickens in the 3- to 16-week age group used in this study. For these dependent variables (proliferation and relative collagen synthesis), there was no interaction between donor age and ELF electric field exposure.

Coghill, R. W., et al. (1996). "Extra low frequency electric and magnetic fields in the bedplace of children diagnosed with leukaemia: a case-control study." European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation **5**(3): 153-158.

This retrospective case-control study of 56 cases and 56 controls measured extra low frequency (ELF) electric and magnetic fields between 2000 h and 0800 h in the bedplaces of children with leukaemia. Mean ELF electric field (E-field) levels found in case homes of 13.9 Vm-1 (SD: 13.6) were significantly higher (P < 0.01) compared with only 7.3 Vm-1 (SD: 12.9) in controls matched for age and sex. Moreover, applying conditional logistic regression, a dose-response relationship emerged between E-field exposure and incidence: above 20 Vm-1 the relative risk was 4.69 (95% CI: 1.17-27.78; P = 0.025), whereas at levels of 10-19 Vm-1 it was 2.40 (95% CI: 0.79-8.09) and at levels of 5-9 Vm-1 it was only 1.46 (95% CI: 0.47-5.10). By contrast, similar readings of the rms ELF magnetic field found no significant case-control differences: mean levels in cases' homes of 0.070 microT (SD: 0.070) compared with 0.057 microT (SD: 0.038) in controls. Although there were imperfections in the study design, it is concluded that the importance of the E-field may have been overlooked in epidemiological studies to date.

Colvis, C. M., et al. (2005). "Epigenetic mechanisms and gene networks in the nervous system." The Journal of neuroscience **25**(45): 10379-10389.

Colwell, C. S. (2011). "Linking neural activity and molecular oscillations in the SCN." Nature reviews. Neuroscience **12**(10): 553-569.

Neurons in the suprachiasmatic nucleus (SCN) function as part of a central timing circuit that drives daily changes in our behaviour and underlying physiology. A hallmark feature of SCN neuronal populations is that they are mostly electrically silent during the night, start to fire action potentials near dawn and then continue to generate action potentials with a slow and steady pace all day long. Sets of currents are responsible for this daily rhythm, with the strongest evidence for persistent Na(+) currents, L-type Ca(2+) currents, hyperpolarization-activated currents (I(H)), large-conductance Ca(2+) activated K(+) (BK) currents and fast delayed rectifier (FDR) K(+) currents. These rhythms in electrical activity are crucial for the function of the circadian timing system, including the expression of clock genes, and decline with ageing and disease. This article reviews our current understanding of the ionic and molecular mechanisms that drive the rhythmic firing patterns in the SCN.

Consultation, W. (2000). "Obesity: preventing and managing the global epidemic." World Health Organization technical report series **894**.

Cos, S., et al. (1991). "Effects of melatonin on the cell cycle kinetics and "estrogen-rescue" of MCF-7 human breast cancer cells in culture." Journal of pineal research **10**(1): 36-42.

Melatonin has been shown to have a direct inhibitory action on the proliferation of estrogen-responsive MCF-7 human breast cancer cells in culture. In the present study, we examined by flow cytometry whether this inhibitory effect might be exerted on the G1 phase of the cell cycle, thus causing a transition delay into the S phase. In order to further verify this hypothesis we tested the ability of estradiol to "rescue" MCF-7 cells from melatonin inhibition, and the potential of this indoleamine to block the ability of estradiol to rescue the cells from tamoxifen inhibition. Following five days of incubation, melatonin (10(-9)M) increased the fraction of cells in G1 of the cell cycle while simultaneously causing a 50% reduction in the proportion of cells in S phase. The antiproliferative effect of melatonin (10(-5)M) was prevented by the simultaneous treatment of the cells with estradiol (10(-8)M) in clonogenic soft agar culture, or reversed by the addition

of estradiol to cells previously incubated with and inhibited by melatonin (10(-9)M) in monolayer culture. Additionally, melatonin blocked the estrogen-rescue of tamoxifen-inhibited cells in both types of culture systems. These results support the hypothesis that the antiproliferative effect of melatonin, like tamoxifen, is cell cycle specific by causing a G1-S transition delay. These results also indicate an important interaction of melatonin with estrogen-mediated mechanisms of MCF-7 cell proliferation.

Devaskar, S. U. and S. Raychaudhuri (2007). "Epigenetics‚Äìa science of heritable biological adaptation." Pediatric research 61: 1R-4R.

Dubrov, A. P. (1978). The Geomagnetic Field and Life - Geomagnetobiology. New York, Plenum Press.

Fattahi-asl, J., et al. (2012). "Effects of Radiofrequency Radiation on Human Ferritin: An In-Vitro Enzymun Assay." Journal of Medical Signals and Sensors **2**(4).

Ferritin is a macromolecule and is responsible for the long term iron storage function in human serum and plasma. Recent studies have highlighted the role of cell phone exposure on central nervous system, immune function and reproduction. The aim of this study was to investigate whether the human serum ferritin level could be interfered by the exposure to the 900 MHz GSM cell phones. Fifty human serum wells from 25 normal healthy donors were labeled with ruthenium to form a sandwich complex based on an immunoassay technique. All of them were placed into two batches, and the well heads in the first batch were exposed to 900 MHz exposure emitted from a speech mode cell phone (Nokia, Model 1202, India) for 30 min. Unexposed batch was served as the control sample under identical conditions and was compared with the exposed one in quantitative determination of ferritin using the Wilcoxon test with criterion level of P = 0.050. Human serum wells in the exposed batch showed a significant decrease in serum ferritin relative to the control batch (P = 0.029). The average ± SD ferritin level in the exposed batch was 84.94 ± 1.04 µg/L while it was 87.25 ± 0.83 µg/L for the unexposed batch. Radiofrequency electromagnetic waves emitted from cell phones may lead to oxidative stress and rapid diffusion of the human ferritin level in an in vitro enzymun assay. Also, the enzyme activity can be affected. Effects of exposure from mobile phones must be considered further.

Feinberg, A. P., et al. (2002). DNA methylation and genomic imprinting: insights from cancer into epigenetic mechanisms. Seminars in cancer biology, Elsevier.

Feychting, M. and A. Ahlbom (1993). "Magnetic fields and cancer in children residing near Swedish high-voltage power lines." American journal of epidemiology **138**(7): 467-481.

A case-control study was conducted to test the hypothesis that exposure to magnetic fields of the type generated by high-voltage power lines increases cancer incidence in children. The study base consisted of everyone under age 16 years who had lived on a property located within 300 meters of any of the 220 and 400 kV power lines in Sweden during the period 1960-1985. Subjects were followed from their entry into the study base through 1985. A total of 142 cancer cases were identified through a record linkage to the Swedish Cancer Registry. There were 39 leukemia and 33 central nervous system tumor cases. A total of 558 controls were selected at random from the study base. Exposure was assessed by spot measurements and by calculations of the magnetic fields generated by the power lines, taking distance, line configuration, and load into account. Information about historical loads on the power lines was used to calculate the magnetic fields for the year closest in time to diagnosis. When historical calculations were used as exposure assessment for childhood leukemia with cutoff points at 0.1 and 0.2 microtesla (microT), the estimated relative risk increased over the two exposure levels and was estimated at 2.7 (95% confidence interval (CI) 1.0-6.3) for 0.2 microT and over; p for trend = 0.02. When the upper cutoff point was shifted to 0.3 microT, the relative risk was 3.8 (95% CI 1.4-9.3); p for trend = 0.005. These results persisted when adjustment for potential confounding factors was made. For central nervous system tumor, lymphoma, and all childhood cancers combined, there was no support for an association.

Feychting, M. and A. Ahlbom (1994). "Magnetic fields, leukemia, and central nervous system tumors in Swedish adults residing near high-voltage power lines." Epidemiology **5**(5): 501-509.

We conducted a case-control study to test the hypothesis that exposure to magnetic fields of the type generated by high-voltage power lines increases the incidence of leukemia and central nervous system tumors in adults. The study was based on people who, between 1960 and 1985, had lived on a property in Sweden located within 300 meters of 220 or 400 kilovolt power lines. We identified a total of 325 leukemia cases and 223 cases of central nervous system tumor. Two matched controls per case were selected at random. We assessed exposure by spot measurements and by calculations of the magnetic fields generated by the power lines. For calculated magnetic field levels of 0.2 microT or more closest in time to diagnosis, we found an elevated relative risk (RR) for acute myeloid leukemia [RR = 1.7; 95% confidence interval (CI) = 0.8-3.5] and chronic myeloid leukemia [RR = 1.7; 95% CI = 0.7-3.8]. Using cumulative exposure for the 15 years preceding diagnosis, we found relative risk estimates for acute and chronic myeloid leukemia of 2.3 (95% CI = 1.0-4.6) and 2.1 (95% CI = 0.9-4.7), respectively, for the highest exposure category. For chronic lymphatic leukemia and for central nervous system tumors, relative risk estimates were close to or below unity.

Feychting M., A. A. (1995). "Childhood leukemia and residential exposure to weak extremely low frequency magnetic fields." Environ. Health Perspect **suppl 2**: 59-62.

Filippova, G. N. (2007). "Genetics and epigenetics of the multifunctional protein CTCF." Current topics in developmental biology **80**: 337-360.

Froy, O. (2011). "The circadian clock and metabolism." Clinical Science **120**(2): 65-72.

Mammals have developed an endogenous circadian clock located in the SCN (suprachiasmatic nuclei) of the anterior hypothalamus that responds to the environmental light-dark cycle. Human homoeostatic systems have adapted to daily changes in a way that the body anticipates the sleep and activity periods. Similar clocks have been found in peripheral tissues, such as the liver, intestine and adipose tissue. Recently it has been found that the circadian clock regulates cellular and physiological functions in addition to the expression and/or activity of enzymes and hormones involved in metabolism. In turn, key metabolic enzymes and transcription activators interact with and affect the core clock mechanism. Animals with mutations in clock genes that disrupt cellular rhythmicity have provided evidence to the relationship between the circadian clock and metabolic homoeostasis. The present review will summarize recent findings concerning the relationship between metabolism and circadian rhythms.

Giuliani, A., Soffritti, M. (2010). "NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER." RAMAZZINI INSTITUTE EUR. J. ONCOL. LIBRARY **5**.

Godfrey, K. M., et al. (2007). "Epigenetic mechanisms and the mismatch concept of the developmental origins of health and disease." Pediatric research **61**: 5R-10R.

Goodman E.M., G. B. a. M. M. T. (1995). ""Effects of Electro- magnetic Fields on Mollecules and Cells"." International Rev. Cytol. **158**: 279-338.

Hafner, M., et al. (2012). "Effect of network architecture on synchronization and entrainment properties of the circadian oscillations in the suprachiasmatic nucleus." PLoS computational biology **8**(3): e1002419.

In mammals, the suprachiasmatic nucleus (SCN) of the hypothalamus constitutes the central circadian pacemaker. The SCN receives light signals from the retina and controls peripheral circadian clocks (located in the cortex, the pineal gland, the liver, the kidney, the heart, etc.). This hierarchical organization of the circadian system ensures the proper timing of physiological processes. In each SCN neuron, interconnected transcriptional and translational feedback loops enable the circadian expression of the clock genes. Although all the neurons have the same genotype, the oscillations of individual cells are highly heterogeneous in dispersed cell culture: many cells present damped oscillations and the period of the oscillations varies from cell to cell. In addition, the neurotransmitters that ensure the intercellular coupling, and thereby the synchronization of the cellular rhythms, differ between the two main regions of the SCN. In this

work, a mathematical model that accounts for this heterogeneous organization of the SCN is presented and used to study the implication of the SCN network topology on synchronization and entrainment properties. The results show that oscillations with larger amplitude can be obtained with scale-free networks, in contrast to random and local connections. Networks with the small-world property such as the scale-free networks used in this work can adapt faster to a delay or advance in the light/dark cycle (jet lag). Interestingly a certain level of cellular heterogeneity is not detrimental to synchronization performances, but on the contrary helps resynchronization after jet lag. When coupling two networks with different topologies that mimic the two regions of the SCN, efficient filtering of pulse-like perturbations in the entrainment pattern is observed. These results suggest that the complex and heterogeneous architecture of the SCN decreases the sensitivity of the network to short entrainment perturbations while, at the same time, improving its adaptation abilities to long term changes.

Hallberg, O. and O. Johansson (2002). "Melanoma incidence and frequency modulation (FM) broadcasting." Archives of Environmental Health **57**(1): 32-40.

The incidence of melanoma has been increasing steadily in many countries since 1960, but the underlying mechanism causing this increase remains elusive. The incidence of melanoma has been linked to the distance to frequency modulation (FM) broadcasting towers. In the current study, the authors sought to determine if there was also a related link on a larger scale for entire countries. Exposure-time-specific incidence was extracted from exposure and incidence data from 4 different countries, and this was compared with reported age-specific incidence of melanoma. Geographic differences in melanoma incidence were compared with the magnitude of this environmental stress. The exposure-time-specific incidence from all 4 countries became almost identical, and they were approximately equal to the reported age-specific incidence of melanoma. A correlation between melanoma incidence and the number of locally receivable FM transmitters was found. The authors concluded that melanoma is associated with exposure to FM broadcasting.

Hardell L, C. M., Söderqvist F, Mild KH, Morgan LL. (2007). "Long-term use of cellular phones and brain tumours: increased risk associated with use for > or =10 years." Occup Environ. Med. **64**(9): 626-632. Review.

Hardell L, C. M., Mild KH. (2009). "Epidemiological evidence for an association between use of wireless phones and tumor diseases. ." Pathophysiology. **16**((2-3)): 113-122.

Hardell L., C. M. (2009). "Mobile phones, cordless phones and the risk for brain tumours." International Journal of Oncology **35**: 5-17.

Harst, W., et al. (2006). "Can Electromagnetic Exposure Cause a Change in Behaviour?".

In recent years the public discussion has been focused increasingly on possible unhealthy effects of high-frequency electromagnetic fields (particularly of mobile-phones) on human beings. Whereas thermal effects of this radiation could be explained very well, non-thermal effects could hardly be clarified. In our last works, we pointed out that – from view of Educational Informatics – honey bees are suitable bioindicators to serve as a model of a living being to study learning processes especially in this aspect. In this paper, we describe a first pilot study, which explores the non-thermal influence of highfrequency electromagnetic fields. Therefore we observe the behaviour of honey bees (apis mellifera carnica) by exposing them to the radiation of DECT-phones. In this study four respectively eight bee-colonies were used as experimental group and were irradiated, whereas the same numbers of comparable bee-colonies was field-free. The observed parameters were the building behaviour of the bees within the beehive, its weight and especially the bees' returning behaviour.

Huang, L., et al. (2009). "The involvement of Ca2+ and integrins in directional responses of zebrafish keratocytes to electric fields." Journal of cellular physiology **219**(1): 162-172.

Many cells respond directionally to small DC electrical fields (EFs) by an unknown mechanism, but changes in intracellular Ca(2+) are widely assumed to be involved. We have used zebrafish (Danio rerio) keratocytes in an effort to understand the nature of the EF-cell interaction. We find

that the adult zebrafish integument drives substantial currents outward through wounds produced by scale removal, establishing that keratocytes near the wound will experience endogenous EFs. Isolated keratocytes in culture turn toward the cathode in fields as small as 7 mV mm(-1), and the response is independent of cell size. Epidermal sheets are similarly sensitive. The frequency of intracellular Ca(2+) spikes and basal Ca(2+) levels were increased by EFs, but the spikes were not a necessary aspect of migration or EF response. Two-photon imaging failed to detect a pattern of gradients of Ca(2+) across the lamellipodia during normal or EF-induced turning but did detect a sharp, stable Ca(2+) gradient at the junction of the lamellipodium and the cell body. We conclude that gradients of Ca(2+) within the lamellipodium are not required for the EF response. Immunostaining revealed an anode to cathode gradient of integrin beta1 during EF-induced turning, and interference with integrin function attenuated the EF response. Neither electrophoretic redistribution of membrane proteins nor asymmetric perturbations of the membrane potential appear to be involved in the EF response, and we propose a new model in which hydrodynamic forces generated by electro-osmotic water flow mediate EF-cell interactions via effects on focal adhesions.

Huss, A., et al. (2004). "Symptoms attributed to the environment--a systematic, interdisciplinary assessment." Int J Hyg Environ Health **207**(3): 245-254.

PROBLEM: To assess symptoms attributed to the environment from an interdisciplinary perspective and to evaluate the plausibility of the participants' individual theory of a causal relationship between exposure and health impairment. METHOD: We assessed the medical, psychiatric and environmental background in every participant in an environmental medicine project and discussed the explanatory value of our findings for each reported symptom. RESULTS: Every second participant had at least one symptom that could be plausibly explained by simultaneously occurring medical, psychological or environmental findings. In 40% of the participants the research team rated the association between an environmental exposure and the health complaints to be 'plausible'. Psychiatric disorders were frequent, but did not exclude environmentally caused symptoms. CONCLUSION: Only an interdisciplinary structure including medical, psychiatric and environmental expertise is likely to adequately diagnose and advise persons with environmentally related symptoms.

Imai, K. and H. Yamamoto (2008). "Carcinogenesis and microsatellite instability: the interrelationship between genetics and epigenetics." Carcinogenesis **29**(4): 673-680.

Jaffe, L. F. (1979). "Control of development by ionic currents." Society of General Physiologists series **33**: 199-231.

Johansson, O. (2009). "Disturbance of the immune system by electromagnetic fields-A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment." Pathophysiology : the official journal of the International Society for Pathophysiology / ISP **16**(2-3): 157-177.

A number of papers dealing with the effects of modern, man-made electromagnetic fields (EMFs) on the immune system are summarized in the present review. EMFs disturb immune function through stimulation of various allergic and inflammatory responses, as well as effects on tissue repair processes. Such disturbances increase the risks for various diseases, including cancer. These and the EMF effects on other biological processes (e.g. DNA damage, neurological effects, etc.) are now widely reported to occur at exposure levels significantly below most current national and international safety limits. Obviously, biologically based exposure standards are needed to prevent disruption of normal body processes and potential adverse health effects of chronic exposure. Based on this review, as well as the reviews in the recent Bioinitiative Report [http://www.bioinitiative.org/] [C.F. Blackman, M. Blank, M. Kundi, C. Sage, D.O. Carpenter, Z. Davanipour, D. Gee, L. Hardell, O. Johansson, H. Lai, K.H. Mild, A. Sage, E.L. Sobel, Z. Xu, G. Chen, The Bioinitiative Report-A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF), 2007)], it must be concluded that the existing public safety limits are inadequate to protect public health, and that new public safety limits, as well as limits on further deployment of untested technologies, are warranted.

Johansson, O. (2009). "Disturbance of the immune system by electromagnetic fields--A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment." Pathophysiology **16**(2-3): 157-177.

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Jones, P. A. and S. B. Baylin (2002). "The fundamental role of epigenetic events in cancer." Nature reviews genetics **3**(6): 415-428.

Kalsbeek, A., et al. (2011). "Circadian disruption and SCN control of energy metabolism." FEBS letters **585**(10): 1412-1426.

In this review we first present the anatomical pathways used by the suprachiasmatic nuclei to enforce its rhythmicity onto the body, especially its energy homeostatic system. The experimental data show that by activating the orexin system at the start of the active phase, the biological clock not only ensures that we wake up on time, but also that our glucose metabolism and cardiovascular system are prepared for increased activity. The drawback of such a highly integrated system, however, becomes visible when our daily lives are not fully synchronized with the environment. Thus, in addition to increased physical activity and decreased intake of high-energy food, also a well-lighted and fully resonating biological clock may help to withstand the increasing "diabetogenic" pressure of today's 24/7 society.

Kato, Y. and O. Johansson (2012). "Reported functional impairments of electrohypersensitive Japanese: A questionnaire survey." Pathophysiology.

An increasing number of people worldwide complain that they have become electromagnetic hypersensitive (EHS). We conducted a questionnaire survey of EHS persons in Japan. The aim was to identify electromagnetic fields (EMF) and plausible EMF sources that caused their symptoms. Postal questionnaires were distributed via a self-help group, and 75 participants (95% women) responded. Reported major complaints were "fatigue/tiredness" (85%), "headache", "concentration, memory, and thinking" difficulty (81%, respectively). Seventy-two per cent used some form of complementary/alternative therapy. The most plausible trigger of EHS onset was a mobile phone base station or personal handy-phone system (37%). Sixty-five percent experienced health problems to be due to the radiation from other passengers' mobile phones in trains or buses, and 12% reported that they could not use public transportation at all. Fifty-three percent had a job before the onset, but most had lost their work and/or experienced a decrease in income. Moreover, 85.3% had to take measures to protect themselves from EMF, such as moving to low EMF areas, or buying low EMF electric appliances. EHS persons were suffering not only from their symptoms, but also from economical and social problems.

Kawasaki, A., Kardon, R. H. (2007). "Intrinsically photosensitive retinal ganglion cells." Journal of neuro-ophthalmology : the official journal of the North American Neuro-Ophthalmology Society **27**(3): 195-204.

The recent discovery of melanopsin-expressing retinal ganglion cells that mediate the pupil light reflex has provided new insights into how the pupil responds to different properties of light. These ganglion cells are unique in their ability to transduce light into electrical energy. There are

parallels between the electrophysiologic behavior of these cells in primates and the clinical pupil response to chromatic stimuli. Under photopic conditions, a red light stimulus produces a pupil constriction mediated predominantly by cone input via trans-synaptic activation of melanopsin-expressing retinal ganglion cells, whereas a blue light stimulus at high intensity produces a steady-state pupil constriction mediated primarily by direct intrinsic photoactivation of the melanopsin-expressing ganglion cells. Preliminary data in humans suggest that under photopic conditions, cones primarily drive the transient phase of the pupil light reflex, whereas intrinsic activation of the melanopsin-expressing ganglion cells contributes heavily to sustained pupil constriction. The use of chromatic light stimuli to elicit transient and sustained pupil light reflexes may become a clinical pupil test that allows differentiation between disorders affecting photoreceptors and those affecting retinal ganglion cells.

Khurana, V. G., et al. (2009). "Cell phones and brain tumors: a review including the long-term epidemiologic data." Surgical Neurology **72**(3): 205-214; discussion 214-205.

BACKGROUND: The debate regarding the health effects of low-intensity electromagnetic radiation from sources such as power lines, base stations, and cell phones has recently been reignited. In the present review, the authors attempt to address the following question: is there epidemiologic evidence for an association between long-term cell phone usage and the risk of developing a brain tumor? Included with this meta-analysis of the long-term epidemiologic data are a brief overview of cell phone technology and discussion of laboratory data, biological mechanisms, and brain tumor incidence. METHODS: In order to be included in the present meta-analysis, studies were required to have met all of the following criteria: (i) publication in a peer-reviewed journal; (ii) inclusion of participants using cell phones for > or = 10 years (ie, minimum 10-year "latency"); and (iii) incorporation of a "laterality" analysis of long-term users (ie, analysis of the side of the brain tumor relative to the side of the head preferred for cell phone usage). This is a meta-analysis incorporating all 11 long-term epidemiologic studies in this field. RESULTS: The results indicate that using a cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head as that preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma. CONCLUSION: The authors conclude that there is adequate epidemiologic evidence to suggest a link between prolonged cell phone usage and the development of an ipsilateral brain tumor.

Laird, P. W. and R. Jaenisch (1996). "The role of DNA methylation in cancer genetics and epigenetics." Annual review of genetics **30**(1): 441-464.

Lakatta, E. G., et al. (2010). "A coupled SYSTEM of intracellular Ca2+ clocks and surface membrane voltage clocks controls the timekeeping mechanism of the heart's pacemaker." Circulation research **106**(4): 659-673.

Ion channels on the surface membrane of sinoatrial nodal pacemaker cells (SANCs) are the proximal cause of an action potential. Each individual channel type has been thoroughly characterized under voltage clamp, and the ensemble of the ion channel currents reconstructed in silico generates rhythmic action potentials. Thus, this ensemble can be envisioned as a surface "membrane clock" (M clock). Localized subsarcolemmal Ca(2+) releases are generated by the sarcoplasmic reticulum via ryanodine receptors during late diastolic depolarization and are referred to as an intracellular "Ca(2+) clock," because their spontaneous occurrence is periodic during voltage clamp or in detergent-permeabilized SANCs, and in silico as well. In spontaneously firing SANCs, the M and Ca(2+) clocks do not operate in isolation but work together via numerous interactions modulated by membrane voltage, subsarcolemmal Ca(2+), and protein kinase A and CaMKII-dependent protein phosphorylation. Through these interactions, the 2 subsystem clocks become mutually entrained to form a robust, stable, coupled-clock system that drives normal cardiac pacemaker cell automaticity. G protein-coupled receptors signaling creates pacemaker flexibility, ie, effects changes in the rhythmic action potential firing rate, by impacting on these very same factors that regulate robust basal coupled-clock system function. This review examines evidence that forms the basis of this coupled-clock system concept in cardiac SANCs.

Lantz, P. M., et al. (2005). "Stress, life events, and socioeconomic disparities in health: results from the Americans' Changing Lives Study." Journal of Health and Social Behavior **46**(3): 274-288.

Lee, J., et al. (2008). "Epigenetic-mediated dysfunction of the bone morphogenetic protein pathway inhibits differentiation of glioblastoma-initiating cells." Cancer cell **13**(1): 69-80.

Leuchtag, R. (1992). "Does the Na channel conduct ions through a water-filled pore or a condensed state pathway?" Biophys. J. **62**: 22-24.

Leuchtag, R. (1994). "Long-Range Interactions, Voltage Sensitivity, and Ion Conduction in S4 Segments of Excitable Channels." Biophys. J. **66**: 217-224.

Liburdy, R. P., et al. (1993). "ELF magnetic fields, breast cancer, and melatonin: 60 Hz fields block melatonin's oncostatic action on ER+ breast cancer cell proliferation." Journal of pineal research **14**(2): 89-97.

> In this study we investigated whether a 60 Hz magnetic field can act at the cellular level to influence the growth of human estrogen-dependent breast cancer cells. Our experimental design assessed cell proliferation of a human breast cancer cell line, MCF-7, in the absence or the presence of melatonin which inhibits growth at a physiological concentration of 10(-9) M. In three experiments, continuous exposure to average sinusoidal 60 Hz magnetic fields of 1.90 +/- 0.01, 2.40 +/- 0.70, and 2.53 +/- 0.50 mG, or simultaneous exposure in matched incubators to average 60 Hz magnetic fields of 10.4 +/- 2.12, 11.95 +/- 2.73, and 11.95 +/- 3.28 mG, respectively, had no effect on cell proliferation in the absence of melatonin. When MCF-7 cells were cultured in the presence of 10(-9) M melatonin, an 18% inhibition of growth was observed for cells in a 2.40 +/- 0.70 mG field. This effect was blocked by a 60 Hz magnetic field of 11.95 +/- 2.75 mG. In a second experiment, a 27% inhibition of MCF-7 cell growth was observed for cells in a 2.53 +/- 0.50 mG magnetic field, and this was blocked by a 60 Hz magnetic field of 11.95 +- 3.28 mG. These results provide the first evidence that ELF frequency magnetic fields can act at the cellular levels to enhance breast cancer cell proliferation by blocking melatonin's natural oncostatic action. In addition, there appears to be a dose threshold between 2 and 12 mG. The mechanism(s) of action is unknown and may involve modulation of signal transduction events associated with melatonin's regulation of cell growth.

Lichtenstein, P., et al. (2000). "Environmental and heritable factors in the causation of cancer,Äîanalyses of cohorts of twins from Sweden, Denmark, and Finland." New England Journal of Medicine **343**(2): 78-85.

Litovitz, T., et al. (1994). "Temporally incoherent magnetic fields mitigate the response of biological systems to temporally coherent magnetic fields." Bioelectromagnetics **15**(5): 399-410.

> We have previously demonstrated that a weak, extremely-low-frequency magnetic field must be coherent for some minimum length of time (≈ 10 s) in order to affect the specific activity of ornithine decarboxylase (ODC) in L929 mouse cells. In this study we explore whether or not the superposition of an incoherent (noise) magnetic field can block the bioeffect of a coherent 60 Hz magnetic field, since the sum of the two fields is incoherent. An experimental test of this idea was conducted using as a biological marker the twofold enhancement of ODC activity found in L929 murine cells after exposure to a 60 Hz, 10 μTrms magnetic field. We superimposed an incoherent magnetic noise field, containing frequencies from 30 to 90 Hz, whose rms amplitude was comparable to that of the 60 Hz field. Under these conditions the ODC activity observed after exposure was equal to control levels. It is concluded that the superposition of incoherent magnetic fields can block the enhancement of ODC activity by a coherent magnetic field if the strength of the incoherent field is equal to or greater than that of the coherent field. When the superimposed, incoherent noise field was reduced in strength, the enhancement of ODC activity by the coherent field increased. Full ODC enhancement was obtained when the rms value of the applied EM noise was less than one-tenth that of the coherent field. These results are discussed in relation to the question of cellular detection of weak EM fields in the presence of endogenous thermal noise fields.

Litovitz, T., et al. (1998). "Bioeffects induced by exposure to microwaves are mitigated by superposition of ELF noise." Bioelectromagnetics **18**(6): 422-430.

> We have previously demonstrated that microwave fields, amplitude modulated (AM) by an extremely low-frequency (ELF) sine wave, can induce a nearly twofold enhancement in the activity of ornithine decarboxylase (ODC) in L929 cells at SAR levels of the order of 2.5 W/kg. Similar, although less pronounced, effects were also observed from exposure to a typical digital cellular phone test signal of the same power level, burst modulated at 50 Hz. We have also shown that ODC enhancement in L929 cells produced by exposure to ELF fields can be inhibited by superposition of ELF noise. In the present study, we explore the possibility that similar inhibition techniques can be used to suppress the microwave response. We concurrently exposed L929 cells to 60 Hz AM microwave fields or a 50 Hz burst-modulated DAMPS (Digital Advanced Mobile Phone System) digital cellular phone field at levels known to produce ODC enhancement, together with band-limited 30–100 Hz ELF noise with root mean square amplitude of up to 10 μT. All exposures were carried out for 8 h, which was previously found to yield the peak microwave response. In both cases, the ODC enhancement was found to decrease exponentially as a function of the noise root mean square amplitude. With 60 Hz AM microwaves, complete inhibition was obtained with noise levels at or above 2 μT. With the DAMPS digital cellular phone signal, complete inhibition occurred with noise levels at or above 5 μT. These results suggest a possible practical means to inhibit biological effects from exposure to both ELF and microwave fields

Lu, Y. S., Huang, B.T., Huang, Y.X. (2012). "Reactive Oxygen Species Formation and Apoptosis in Human Peripheral Blood Mononuclear Cell Induced by 900 MHz Mobile Phone Radiation." Oxid Med Cell Longev.

> We demonstrate that reactive oxygen species (ROS) plays an important role in the process of apoptosis in human peripheral blood mononuclear cell (PBMC) which is induced by the radiation of 900MHz radiofrequency electromagnetic field (RFEMF) at a specific absorption rate (SAR) of ~0.4W/kg when the exposure lasts longer than two hours. The apoptosis is induced through the mitochondrial pathway and mediated by activating ROS and caspase-3, and decreasing the mitochondrial potential. The activation of ROS is triggered by the conformation disturbance of lipids, protein, and DNA induced by the exposure of GSM RFEMF. Although human PBMC was found to have a self-protection mechanism of releasing carotenoid in response to oxidative stress to lessen the further increase of ROS, the imbalance between the antioxidant defenses and ROS formation still results in an increase of cell death with the exposure time and can cause about 37% human PBMC death in eight hours.

Lundkvist, G. B. and G. D. Block (2005). "Role of neuronal membrane events in circadian rhythm generation." Methods in enzymology **393**: 623-642.

> Circadian clock systems are composed of an input or "entrainment" pathway by which synchronization to the external environment occurs, a pacemaker responsible for generating rhythmicity, and an output or "expression" pathway through which rhythmic signals act to modulate physiology and behavior. The circadian pacemaker contains molecular feedback loops of rhythmically expressed genes and their protein products, which, through interactions, generate a circa 24-h cycle of transcription and translation of clock and clock-controlled genes. Neuronal membrane events appear to play major roles in entrainment of circadian rhythms in mollusks and mammals. In mammals, the suprachiasmatic nuclei of the hypothalamus receive photic information via the retinohypothalamic tract. Retinal signals, mediated by glutamate, induce calcium release and activate a number of intracellular cascades involved in photic gating and phase shifting. Membrane events are also involved in rhythm expression. Calcium and potassium currents influence the electrical output of pacemaker neurons by altering shape and intervals of impulse prepotentials, afterhyperpolarization periods, and interspike intervals, as well as altering membrane potentials and thereby shaping the spontaneous rhythmic spiking patterns. Unlike the involvement of membrane events in circadian entrainment and expression, it is less clear whether electrical activity, postsynaptic events, and transmembrane ion fluxes also are essential elements in rhythm generation. Studies, however, suggest that neuronal membrane activity may indeed play a crucial role in circadian rhythm generation.

Mazzoccoli, G., et al. (2012). "Clock genes and clock-controlled genes in the regulation of metabolic rhythms." Chronobiology international **29**(3): 227-251.

Daily rotation of the Earth on its axis and yearly revolution around the Sun impose to living organisms adaptation to nyctohemeral and seasonal periodicity. Terrestrial life forms have developed endogenous molecular circadian clocks to synchronize their behavioral, biological, and metabolic rhythms to environmental cues, with the aim to perform at their best over a 24-h span. The coordinated circadian regulation of sleep/wake, rest/activity, fasting/feeding, and catabolic/anabolic cycles is crucial for optimal health. Circadian rhythms in gene expression synchronize biochemical processes and metabolic fluxes with the external environment, allowing the organism to function effectively in response to predictable physiological challenges. In mammals, this daily timekeeping is driven by the biological clocks of the circadian timing system, composed of master molecular oscillators within the suprachiasmatic nuclei of the hypothalamus, pacing self-sustained and cell-autonomous molecular oscillators in peripheral tissues through neural and humoral signals. Nutritional status is sensed by nuclear receptors and coreceptors, transcriptional regulatory proteins, and protein kinases, which synchronize metabolic gene expression and epigenetic modification, as well as energy production and expenditure, with behavioral and light-dark alternance. Physiological rhythmicity characterizes these biological processes and body functions, and multiple rhythms coexist presenting different phases, which may determine different ways of coordination among the circadian patterns, at both the cellular and whole-body levels. A complete loss of rhythmicity or a change of phase may alter the physiological array of rhythms, with the onset of chronodisruption or internal desynchronization, leading to metabolic derangement and disease, i.e., chronopathology.

McCaig, C. D., PJ. (1989). "On the mechanism of oriented myoblast differentiation in an applied electric field." Biol. Bull (Woods Hole, Mass.), **176**: 140-144.

McCaig, C. Z., M. (1997). "Physiological Electric Fields Modify Cell Behaviour." Bioessays **19**(9): 819-826.

McKasson, M. J., et al. (2008). "Chick embryonic Schwann cells migrate anodally in small electrical fields." Experimental neurology **211**(2): 585-587.

Little is known about the cues that guide migrating neural crest derivatives to their targets. This lack of understanding is especially significant in the case of Schwann cells, which have been transplanted into the central nervous system in an effort to promote axonal myelination after injury or disease. We have investigated the response of Schwann cells, cultured from the peripheral nerves of E7/8 chick embryos, to applied electrical fields. We find that they respond by migrating to the anode, and show a significant anodal bias in directionality at 3 mV mm(-1). This is the smallest electrical field that has been shown to affect cellular movement or growth in culture, and the anodal direction is surprising given the known cathodal responses of neural crest cells. The effective fields are considerably smaller than endogenous electrical fields that have been measured in embryonic tissues.

McLeod, K. J., et al. (1987). "Frequency dependence of electric field modulation of fibroblast protein synthesis." Science **236**(4807): 1465-1469.

The effect of electric current on protein biosynthesis in mammalian fibroblasts was investigated with neonatal bovine fibroblast-populated collagen matrices. The field strength dependence of electric field modulation of proline incorporation into extracellular and intracellular protein was measured over a frequency range from 0.1 to 1000 hertz. A frequency- and amplitude-dependent reduction in the rate of incorporation was observed. In tissues containing cells aligned either parallel or perpendicular to the electric field, this response was dependent on the orientation of the cells relative to the direction of the applied electric field. This study demonstrates that currents of physiological strength can stimulate alterations in biosynthesis and thereby may influence tissue growth, remodeling, and repair.

Miller, C. (2000). "An overview of the potassium channel family." Genome Biology **1**(4).

Mohn, F. and D. Sch√ºbeler (2009). "Genetics and epigenetics: stability and plasticity during cellular differentiation." Trends in Genetics **25**(3): 129-136.

Moran, D. S., et al. (1998). "A physiological strain index to evaluate heat stress." American Journal of Physiology-Regulatory, Integrative and Comparative Physiology **275**(1): R129-R134.

> physiological strain index (PSI), based on rectal temperature (Tre) and heart rate (HR), capable of indicating heat strain online and analyzing existing databases, has been developed. The index rates the physiological strain on a universal scale of 0–10. It was assumed that the maximal Tre and HR rise during exposure to exercise heat stress from normothermia to hyperthermia was 3°C (36.5–39.5°C) and 120 beats/min (60–180 beats/min), respectively. Tre and HR were assigned the same weight functions as follows: PSI = 5(Tre t− Tre0) · (39.5 − Tre0)−1+ 5(HRt − HR0) · (180 − HR0)−1, where Tre tand HRt are simultaneous measurements taken at any time during the exposure and Tre0 and HR0 are the initial measurements. PSI was applied to data obtained from 100 men performing exercise in the heat (40°C, 40% relative humidity; 1.34 m/s at a 2% grade) for 120 min. A separate database representing seven men wearing protective clothing and exercising in hot-dry and hot-wet environmental conditions was applied to test the validity of the present index. PSI differentiated significantly ($P < 0.05$) between the two climates. This index has the potential to be widely accepted and to serve universally after extending its validity to women and other age groups.

Morimoto, T., et al. (2011). "The habitat disruption induces immune-suppression and oxidative stress in honey bees." Ecology and Evolution **1**(2): 201-217.

> The honey bee is a major insect used for pollination of many commercial crops worldwide. Although the use of honey bees for pollination can disrupt the habitat, the effects on their physiology have never been determined. Recently, honey bee colonies have often collapsed when introduced in greenhouses for pollination in Japan. Thus, suppressing colony collapses and maintaining the number of worker bees in the colonies is essential for successful long-term pollination in greenhouses and recycling of honey bee colonies. To understand the physiological states of honey bees used for long-term pollination in greenhouses, we characterized their gene expression profiles by microarray. We found that the greenhouse environment changes the gene expression profiles and induces immune-suppression and oxidative stress in honey bees. In fact, the increase of the number of Nosema microsporidia and protein carbonyl content was observed in honey bees during pollination in greenhouses. Thus, honey bee colonies are likely to collapse during pollination in greenhouses when heavily infested with pathogens. Degradation of honey bee habitat by changing the outside environment of the colony, during pollination services for example, imposes negative impacts on honey bees. Thus, worldwide use of honey bees for crop pollination in general could be one of reasons for the decline of managed honey bee colonies.

Moritz, M., et al. (2001). "Capability of air filters to retain airborne bacteria and molds in heating, ventilating and air-conditioning (HVAC) systems." International journal of hygiene and environmental health **203**(5): 401-409.

> The capability of air filters (filterclass: F6, F7) to retain airborne outdoor microorganisms was examined in field experiments in two heating, ventilating and air conditioning (HVAC) systems. At the beginning of the 15-month investigation period, the first filter stages of both HVAC systems were equipped with new unused air filters. The number of airborne bacteria and molds before and behind the filters were determined simultaneously in 14 days-intervals using 6-stage Andersen cascade impactors.
>
> Under relatively dry ( 80% R. H.) and warm ( 12°C) outdoor air conditions air filters led to a marked reduction of airborne microorganism concentrations (bacteria by approximately 70% and molds by 80%). However, during long periods of high relative humidity ( 80% R. H.) a proliferation of bacteria on air filters with subsequent release into the filtered air occured. These microorganisms were mainly smaller than 1.1 µm therefore being part of the respirable fraction. The results showed furthermore that one possibility to avoid microbial proliferation is to limit the relative humidity in the area of the air filters to 80% R. H. (mean of 3 days), e. g. by using preheaters in front of air filters in HVAC-systems.

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Narayanan, S. N., et al. (2010). "Effect of radio-frequency electromagnetic radiations (RF-EMR) on passive avoidance behaviour and hippocampal morphology in Wistar rats." Upsala Journal of Medical Sciences **115**(2): 91-96.

Nishimura, K. Y., R. R. Isseroff., R. Nuccitelli. (1996). "Human keratinocytes migrate to the negative pole in direct current electrical fields comparable to those measured in mammalian wounds. ." J. Cell Sci. **109**: 199–207.

Nuccitelli, R. (1988). "Ionic Currents in Morphogenesis." Experientia **44**: 657-666.

Nuccitelli, R. (2000). Endogenous Electric Fields During Development, Regeneration and Wound Healing. Greece.

Nuccitelli, R. (2003). "Endogenous electric fields in embryos during development, regeneration and wound healing." Radiation protection dosimetry **106**(4): 375-383.

> All embryos that have been investigated drive ionic currents through themselves and these currents will generate internal electric fields. Here, those examples in which such fields have been measured directly are discussed. The first such measurements were made in chick embryos and about 20 mV mm(-1) was measured near the posterior intestinal portal in 2-4 day-old embryos. This electric field is important for the development of tail structures because reducing its magnitude results in abnormal tail development. The second embryonic electric field measured directly was in the axolotl, where a rostral-caudal field of about the same magnitude was detected. Modification of this field during neurulation but not gastrulation caused developmental abnormalities. Most recently, the development of left-right asymmetry in frog and chick embryos was found to require a voltage difference between blastomeres at a very early developmental stage. This field was measured in the chick embryo to be 10-20 mV mm(-1) across the primitive streak. Mammalian skin wounds generate 150 mV mm(-1) fields lateral to the wound and corneal epidermal wounds exhibit lateral fields of 40 mV mm(-1). The presence of these endogenous fields would suggest that exposures to external electric fields should be limited to magnitudes of less than 0.1 V m(-1).

Oleksiak, M. F. (2008). "Changes in gene expression due to chronic exposure to environmental pollutants." Aquatic Toxicology **90**(3): 161-171.

> Populations of the teleost fish Fundulus heteroclitus inhabit and have adapted to highly polluted Superfund sites that are contaminated with persistent toxic chemicals. Populations inhabiting different Superfund sites provide independent contrasts for studying mechanisms of toxicity and resistance due to exposure to environmental pollutants. To identify both shared and unique responses to chronic pollutant exposure, liver, metabolic gene expression in F. heteroclitus populations from each of three Superfund sites (New Bedford Harbor, MA; Newark Bay, NJ; and Elizabeth River, VA) were compared to two flanking reference site populations (nine populations in total). In comparisons to their two clean reference sites, the three Superfund sites had 8–32% of genes with altered expression patterns. Between any two Superfund populations, up to nine genes (4%) show a conserved response, yet among all three populations, there was no gene which had a conserved, altered pattern of expression. Across all three Superfund sites in comparison to all six-reference populations, the most significant gene was fatty acid synthase. Fatty acid synthase is involved in the storage of excess energy as fat, and its lesser expression in the polluted populations suggests that the polluted populations may have limited energy stores. In contrast to previous studies of metabolic gene expression in F. heteroclitus, body weight was a significant covariate for many of the genes which could reflect accumulation and different body burdens of pollutants. Overall, the altered gene expression in these populations likely represents both induced and adaptive changes in gene expression.

Pall, M. L. (2013). "Electromagnetic fields act via activation of voltage‚Äêgated calcium channels to produce beneficial or adverse effects." Journal of cellular and molecular medicine.

Panagopoulos D.J., M. L. H. (2003). "Theoretical Considerations for the Biological Effects of Electromagnetic Fields." Springer.: 5-33.

Panagopoulos, D. J. (2011). Analyzing the Health Impacts of Modern Telecommunications Microwaves. New York, Nova Science Publishers, Inc.

Panagopoulos, D. J. (2011). "ANALYZING THE HEALTH IMPACTS OF MODERN TELECOMMUNICATIONS MICROWAVES." Advances in Medicine and Biology. **17**.

> While different classes of biological effects of radiation used in modern telecommunications are already confirmed by different experimenters, a lot of contradictory results are also reported. Despite uncertainties, some of the recent results reporting effects show an intriguing agreement between them, although with different biological models and under different laboratory conditions. Such results of exceptional importance and mutual similarity are those reporting DNA damage or oxidative stress induction on reproductive cells of different organisms, resulting in decreased fertility and reproduction. This distinct similarity among results of different researchers makes unlikely the possibility that these results could be wrong. This chapter analyzes and resumes our experimental findings of DNA damage on insect reproductive cells by Global System for Mobile telecommunications (GSM) radiation, compares them with similar recent results on mammalian-human infertility and discusses the possible connection between these findings and other reports regarding tumour induction, symptoms of unwellness, or declines in bird and insect populations. A possible biochemical explanation of the reported effects at the cellular level is attempted. Since microwave radiation is non-ionizing and therefore unable to break chemical bonds, indirect ways of DNA damage are discussed, through enhancement of free radical and reactive oxygen species (ROS) formation, or irregular release of hydrolytic enzymes. Such events can be initiated by alterations of intracellular ionic concentrations after irregular gating of electrosensitive channels on the cell membranes according to the Ion Forced-Vibration theory that we have previously proposed. This biophysical mechanism seems to be realistic, since it is able to explain all of the reported biological effects associated with exposure to electromagnetic fields (EMFs), including the so-called "windows" of increased bioactivity reported for many years but remaining unexplained so far, and recorded also in our recent experiments regarding GSM radiation exposure. The chapter also discusses an important dosimetry issue, regarding the use of Specific Absorption Rate (SAR), a quantity introduced to describe temperature increases within biological tissue (thermal effects), while the recorded biological effects in their vast majority are non-thermal. Finally the chapter attempts to propose some basic precautions and a different way of network design for mobile telephony base station antennas, in order to minimize the exposure of human population and reduce significantly the current exposure limits in order to account for the reported non thermal biological effects.

Panagopoulos, D. J., et al. (2013). "Evaluation of Specific Absorption Rate as a Dosimetric Quantity for Electromagnetic Fields Bioeffects." PLoS One **8**(6): e62663.

Panagopoulos DJ, J. O., Carlo GL. (2013). "Evaluation of Specific Absorption Rate as a Dosimetric Quantity for Electromagnetic Field Bioeffects." PLoS One, In Press.

Panagopoulos DJ, M. L. (2008). Mobile Telephony Radiation Effects on Living Organisms. New York, Nova Science Publishers.

Phillips, J. L., et al. (2009). "Electromagnetic fields and DNA damage." Pathophysiology : the official journal of the International Society for Pathophysiology / ISP **16**(2-3): 79-88.

> A major concern of the adverse effects of exposure to non-ionizing electromagnetic field (EMF) is cancer induction. Since the majority of cancers are initiated by damage to a cell's genome, studies have been carried out to investigate the effects of electromagnetic fields on DNA and chromosomal structure. Additionally, DNA damage can lead to changes in cellular functions and cell death. Single cell gel electrophoresis, also known as the 'comet assay', has been widely used in EMF research to determine DNA damage, reflected as single-strand breaks, double-strand breaks, and crosslinks. Studies have also been carried out to investigate chromosomal conformational changes and micronucleus formation in cells after exposure to

EMF. This review describes the comet assay and its utility to qualitatively and quantitatively assess DNA damage, reviews studies that have investigated DNA strand breaks and other changes in DNA structure, and then discusses important lessons learned from our work in this area.

Presman, A. S. (1964). "[on the Role of Electromagnetic Fields in Life Processes]." Biofizika **9**: 131-134.

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Pritchard, C., Mayers, A., Baldwin, D. (2013). "Changing patterns of neurological mortality in the 10 major developed countries -1979-2010." Elsevier.

Objectives: To examine whether there is a continued increase in neurological deaths in the major developed countries over the period 1979e2010. Study design: Analyzes changing patterns of neurological deaths and Total Mortality of people aged 55e74 years by sex. Methods: Baseline WHO 3-year average mortality for 1979e81 were compared with changes in 2008e10, for Total Mortality and the neurological categories Nervous Disease, and Alzheimer & other Dementias deaths in rates per million. To control for different diagnostic practice, the focus is upon Total Neurological Deaths in relation to Total Mortality and Odds ratios are calculated. UK Motor Neuron Disease, Parkinson's disease and variant CJD are explored as possible constituent categories of Nervous Disease for other countries. Results: Total Mortality fell substantially in every country, conversely, Nervous Disease and Alzheimer's rose in seven and six countries respectively. Total Neurological Deaths for males and females increased significantly in Australia, Canada, England & Wales, Italy, the Netherlands and especially the USA. Unlike motor neurone disease, variant CJD' deaths in England and Wales did not contribute substantially to the overall neurological increases found. Odds ratios indicated that neurological deaths differentially increased significantly in every country compared to Total Mortality. Conclusions: These results pose a major public health problem, as the epigenetic contribution to these changes, rather than longevity, have serious implications indicating earlier onset of neurological morbidity pressurizing families, health and social care services, with resource implications especially for Australia, Canada, Italy, Netherlands, Spain, the UK and the USA.

Reiter, R. J. (1995). "Reported biological consequences related to the suppression of melatonin by electric and magnetic field exposure." Integrative Psychological and Behavioral Science **30**(4): 314-330.

Reiter, R. R.-C., S. Coto-Montes, A. Boga, JA. Tan, DX. Davis, JM. Konturek, PC. and S. B. Konturek, T. (2011). "The photoperiod, circadian regulation and chronodisruption: the requisite interplay between the suprachiasmatic nuclei and the pineal and gut melatonin. ." J. Physiol. Pharmacol. **62**(3): 269-274.

Reiter, R. R.-C., S. Coto-Montes, A. Boga, JA. Tan, DX. Davis, JM. Konturek, PC. and S. B. Konturek, T. (2011). "The photoperiod, circadian regulation and chronodisruption: the requisite interplay between the suprachiasmatic nuclei and the pineal and gut melatonin. ." J. Physiol. Pharmacol **62**(3): 269-274.

Rodriguez-Antona, C., et al. (2010). "Molecular genetics and epigenetics of the cytochrome P450 gene family and its relevance for cancer risk and treatment." Human Genetics **127**(1): 1-17.

Romero, L. M. (2004). "Physiological stress in ecology: lessons from biomedical research." Trends in Ecology & Evolution **19**(5): 249-255.

Savitz D.A., W. H., Barnes F, John E.M. and Tvrdik J.G. (1988). "Case-control study of childhood cancer and exposure to 60Hz magnetic fields." Am. J. Epidemiol. **128**: 21-38.

Sayre, L. M., et al. (2007). "Oxidative stress and neurotoxicity." Chemical research in toxicology **21**(1): 172-188.

There is increasing awareness of the ubiquitous role of oxidative stress in neurodegenerative disease states. A continuing challenge is to be able to distinguish between oxidative changes that occur early in the disease from those that are secondary manifestations of neuronal degeneration. This perspective highlights the role of oxidative stress in Alzheimer's, Parkinson's, and Huntington's diseases, amyotrophic lateral sclerosis, and multiple sclerosis, neurodegenerative and neuroinflammatory disorders where there is evidence for a primary contribution of oxidative stress in neuronal death, as opposed to other diseases where oxidative stress more likely plays a secondary or by-stander role. We begin with a brief review of the biochemistry of oxidative stress as it relates to mechanisms that lead to cell death, and why the central nervous system is particularly susceptible to such mechanisms. Following a review of oxidative stress involvement in individual disease states, some conclusions are provided as to what further research should hope to accomplish in the field.

Schwartz, W. (2009). "Circadian rhythms: a tale of two nuclei." Curr. Biol. **19**: 460-462.

Sugimura, T. and T. Ushijima (2000). "Genetic and epigenetic alterations in carcinogenesis." Mutation Research Reviews in Mutation Research **462**(2): 235-246.

Precise and deliberate observations on tumors stand true for decades, and then meet mechanistic explanations. The presence of genetic alterations in tumors is now widely accepted, and explains the irreversible nature of tumors. However, observations on tissue differentiation indicated that it shares something in common with carcinogenesis, that is, "epigenetic" changes. Now, DNA methylation in CpG sites is known to be precisely regulated in tissue differentiation, and is supposed to be playing key roles. Many tumor suppressor genes are known to be inactivated by the hypermethylation of their promoter regions. DNA methylation is connected to histone deacetylation and chromatin structure, and regulatory enzymes of DNA methylation are being cloned. Dedifferentiation, dis(dys)differentiation and convergence of cancer cells were studied phenotypically and biochemically, and are now explained from molecular aspects of disturbances in tissue-specific transcription factors. Spontaneous regression of malignant tumors enchanted researchers, and it is now noticed that genes inactivated by hypermethylation are frequently involved in tumors that relatively often undergo spontaneous regression. Carcinogenic mechanisms of some carcinogens seem to involve modifications of epigenetic switch, and some dietary factors also have the possibility to modify the switches. Based on the growing understanding of the roles of DNA methylation, several new methodologies were developed to make a genome-wide search for changes in DNA methylation. Now, a wave of new findings is in sight.

Swanson, J. (2005). "Childhood cancer in relation to distance from high-voltage power lines in England and Wales: a case-control study." Journal of radiological protection : official journal of the Society for Radiological Protection **25**(3): 336-337.

Tang, W.-y. and S.-m. Ho (2007). "Epigenetic reprogramming and imprinting in origins of disease." Reviews in Endocrine and Metabolic Disorders **8**(2): 173-182.

Wang, E. Z., M. (2010). "Regulation of tissue repair and regeneration by electric fields." Chin. J. Traumatol. **13**(1): 55-61.

Warnke, U. (2007). "BEES, BIRDS AND MANKIND."

The bio-scientist Ulrich Warnke is more familiar with nature's electromagnetic housekeeping than most. In this paper, he shows how wise and sensitive nature was about using electrical and magnetic fields in the creation of life. But he can for this reason also convincingly criticise the present foolish and irresponsible interference in nature's housekeeping. It is clear from his paper that the powers that be in politics, the economy and science are in the process of destroying what nature has built up over millions of years. The traces of this destruction have long been evident in our living environment. The paper shows, however, how short-sightedly we are treating not only our health and the economy, but especially also future generations' right to life.1 All of the above is documented not as probabilities but based on reproducible effects. This should give pause also to those who regularly justify their actions with the argument that they are unaware of any proof of damage.

Weaver, D. (1998). "The suprachiasmatic nucleus: A 25-year retrospective." J. Biol. Rhythms. **13**: 100–112.

Weisbrot D, L. H., Ye L, Blank M, Goodman R. (2003). "Effects of mobile phone radiation on reproduction and development in Drosophila melanogaster. ." J Cell Biochem. **89**(1): 48-55.

Weisenseel, M. H. ( 1983). Control of Differentiation and growth by Endogenous Electric Currents. Berlin., Springer –Verlag.

Wertheimer N., L. E. (1979). "Electrical Wiring Configurations and Childhood Cancer." Am. J. Epidemiol. **109**.

Wiener, N. (1963). New Chapters in Cybernetics. London, Eyre and Spottiswoode.

Xia, S., et al. (2005). "Sensitization of glioma cells to Fas-dependent apoptosis by chemotherapy-induced oxidative stress." Cancer research **65**(12): 5248-5255.

Yao, L., McCaig, CD., Zhao M. (2009). "Electrical signals polarize neuronal organelles, direct neuron migration, and orient cell division. ." Hippocampu **19**(9): 855-868.

You, J. S. and P. A. Jones (2012). "Cancer genetics and epigenetics: two sides of the same coin?" Cancer cell **22**(1): 9-20.

Zaki, S. R. (1995). "Hantavirus pulmonary syndrome: pathogenesis of an emerging infectious disease." The American journal of pathology **146**(3): 552.

> A recent outbreak of a severe pulmonary disease in the southwestern United States was etiologically linked to a previously unrecognized bantavirus. The virus has been isolated from its majorreservoir, the deer mouse, Peromyscus maniculatus,and recently named Sin Nombre virus. Clinically, the disease has become known as the bantavirus pulmonary syndrome (HPS). Since May 1993, 44 fatal cases of HPS have been identified through clinicopathological review and immunobistochemical(IHC) testing of tissues from 273 patients who died of an unexplained noncardiogenic pulmonary edema. In 158 cases for which suitable specimens were available, serologicaltesting and/or reverse transcription-polymerase chain reaction (RT-PCR) amplification of extracted RNA was also performed. IHC, serological, and PCR results were concordant for virtually all HPS and non-HPS patients when more than one assay was performed. The prodromal ilness of HPS is similar to that of many other viral diseases. Consistent bematological features include thrombocytopenia, bemoconcentration, neutropbilic leukocytosis with a left shift, and reactivel lymphocytes. Pulmonary bistopatbological features were similar in most of the fatal HPS cases (40/44) and consisted of an interstitial pneumonitis with a variable mononuclear cell infiltrate, edema, and focal byaline membranes. In four cases, bowever, pulmonary features were significantly different and included diffuse alveolar damage and variable degrees of severe air space disorganization. IHC analysis showed widespread presence of bantaviral antigens in endothelial cells of the microvasculature, particularly in the lung. Hantaviral antigens were also observed within follicular dendritic cells, macrophages, and lymphocytes. Hantaviral inclusions were observed in endothelial cells of lungs by thinsection electron microscopy, and their identity was verified by immunogold labeling. Virus-like particles were seen in pulmonary endothelial cells and macropbages. HPS is a newly recognized, often fatal disease, with a spectrum of microscopic morphological changes, which may be an important cause of severe and fatal illness presenting as adult respiratory distress syndrome.

Zalalutdinov, M., et al. (2003). "Frequency entrainment for micromechanical oscillator." Applied Physics Letters **83**(16): 3281-3283.

> We demonstrate synchronization of laser-induced self-sustained vibrations of radio-frequency micromechanical resonators by applying a small pilot signal either as an inertial drive at the natural frequency of the resonator or by modulating the stiffness of the oscillator at double the natural frequency. By sweeping the pilot signal frequency, we demonstrate that the entrainment zone is hysteretic and can be as wide as 4% of the natural frequency of the resonator, 400 times the 1/Q ;1024 half-width of the resonant peak. Possible applications are

discussed based on the wide range of frequency tuning and the power gain provided by the large amplitude of self-oscillations ~controlled by a small pilot signal!.

Ziech, D., et al. (2011). "Reactive Oxygen Species (ROS)--Induced genetic and epigenetic alterations in human carcinogenesis." Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis **711**(1): 167-173.

Cancer is a multistage and complex process characterized by molecular alterations that underlie all three phases of its development: (i) initiation, (ii) promotion and (iii) progression. Some of these molecular events include alterations in gene expression that are regulated by both genetic and epigenetic mechanisms. On the other hand, "oxidative stress" implies a cellular state where ROS production exceeds the cell's ability to metabolize them resulting in excessive accumulation of ROS that overwhelms cellular defenses. Such state has been shown to regulate both genetic and epigenetic cascades underlying altered gene expression in human disease including cancer. Throughout this manuscript, we review the current state of knowledge on the role of ROS-induced oxidative stress in altering the genetic and epigenetic involvement during human carcinogenesis.