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06/03/2015 - March 2015 - Science Update

The following is a quick summary of another twenty papers that have come out over the last few months related to effects of electromagnetic radiation. All papers with a green background are highlighted as being particularly important or relevant.

1. P **Redmayne M, Johansson O**, (September 2014) *Could myelin damage from radiofrequency electromagnetic field exposure help explain the functional impairment electrohypersensitivity? A review of the evidence*, J Toxicol Environ Health B Crit Rev. 2014;17(5):247-58. doi: 10.1080/10937404.2014.923356 [View Author's abstract conclusions] [View on Pubmed]

Myelin provides the electrical insulation for the central and peripheral nervous system and develops rapidly in the first years of life, but continues into mid-life or later. Myelin integrity is vital to healthy nervous system development and functioning. This review outlines the development of myelin through life, and then considers the evidence for an association between myelin integrity and exposure to low-intensity radiofrequency electromagnetic fields (RF-EMFs) typical in the modern world. In RF-EMF peer-reviewed literature examining relevant impacts such as myelin sheath, multiple sclerosis, and other myelin-related diseases, cellular examination was included. There are surprisingly little data available in each area, but considered together a picture begins to emerge in RF-EMF-exposed cases: (1) significant morphological lesions in the myelin sheath of rats; (2) a greater risk of multiple sclerosis in a study subgroup; (3) effects in proteins related to myelin production; and (4) physical symptoms in individuals with functional impairment electrohypersensitivity, many of which are the same as if myelin were affected by RF-EMF exposure, giving rise to symptoms of demyelination. In the latter, there are exceptions; headache is common only in electrohypersensitivity, while ataxia is typical of demyelination but infrequently found in the former group. Overall, evidence from in vivo and in vitro and epidemiological studies suggests an association between RF-EMF exposure and either myelin deterioration or a direct impact on neuronal conduction, which may account for many electrohypersensitivity symptoms. The most vulnerable are likely to be those in utero through to at least mid-teen years, as well as ill and elderly individuals.

2. N **Saha S** *et al*, (November 2014) *Increased apoptosis and DNA double-strand breaks in the embryonic mouse brain in response to very low-dose X-rays but not 50 Hz magnetic fields*, J R Soc Interface. 2014 Nov 6;11(100):20140783. doi: 10.1098/rsif.2014.0783 [View Author's abstract conclusions] [View on Pubmed]

The use of X-rays for medical diagnosis is enhancing exposure to low radiation doses. Exposure to extremely low-frequency electromagnetic or magnetic fields is also increasing. Epidemiological studies show consistent associations of childhood leukaemia with exposure to magnetic fields but any causal relationship is unclear. A limitation in assessing the consequence of such exposure is the availability of sensitive assays. The embryonic neuronal stem and progenitor cell compartments are radiosensitive tissues. Using sensitive assays, we report a statistically significant increase in DNA double-strand break (DSB) formation and apoptosis in the embryonic neuronal stem cell compartment following in utero exposure to 10-200 mGy X-rays. Both endpoints show a linear response. We also show that DSB repair is delayed following exposure to doses below 50 mGy compared with 100 mGy. Thus, we demonstrate in vivo consequences of low-dose radiation. In contrast to these impacts, we did not observe any significant induction of DSBs or apoptosis following exposure to 50 Hz magnetic fields (100 or 300 μT). We conclude that any DSB induction by treatment with magnetic fields is lower than following exposure to 10 mGy X-rays. For comparison, certain procedures involving computed tomography scanning are equivalent to 1-5 mGy X-rays.

3. - **Vijayalaxmi, Scarfi MR**, (September 2014) *International and national expert group evaluations: biological/health effects of radiofrequency fields*, Int J Environ Res Public Health.

2014 Sep 10;11(9):9376-408. doi: 10.3390/ijerph110909376 [View Author's abstract conclusions] [View on Pubmed]

The escalated use of various wireless communication devices, which emit non-ionizing radiofrequency (RF) fields, have raised concerns among the general public regarding the potential adverse effects on human health. During the last six decades, researchers have used different parameters to investigate the effects of in vitro and in vivo exposures of animals and humans or their cells to RF fields. Data reported in peer-reviewed scientific publications were contradictory: some indicated effects while others did not. International organizations have considered all of these data as well as the observations reported in human epidemiological investigations to set-up the guidelines or standards (based on the quality of published studies and the "weight of scientific evidence" approach) for RF exposures in occupationally exposed individuals and the general public. Scientists with relevant expertise in various countries have also considered the published data to provide the required scientific information for policy-makers to develop and disseminate authoritative health information to the general public regarding RF exposures. This paper is a compilation of the conclusions, on the biological effects of RF exposures, from various national and international expert groups, based on their analyses. In general, the expert groups suggested a reduction in exposure levels, precautionary approach, and further research.

4. P **Baek S** *et al*, (October 2014) *Electromagnetic Fields Mediate Efficient Cell Reprogramming into a Pluripotent State*, ACS Nano. 2014 Oct 1. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

Life on Earth is constantly exposed to natural electromagnetic fields (EMFs), and it is generally accepted that EMFs may exert a variety of effects on biological systems. Particularly, extremely low-frequency electromagnetic fields (EL-EMFs) affect biological processes such as cell development and differentiation; however, the fundamental mechanisms by which EMFs influence these processes remain unclear. Here we show that EMF exposure induces epigenetic changes that promote efficient somatic cell reprogramming to pluripotency. These epigenetic changes resulted from EMF-induced activation of the histone lysine methyltransferase Mll2. Remarkably, an EMF-free system that eliminates Earth's naturally occurring magnetic field abrogates these epigenetic changes, resulting in a failure to undergo reprogramming. Therefore, our results reveal that EMF directly regulates dynamic epigenetic changes through Mll2, providing an efficient tool for epigenetic reprogramming including the acquisition of pluripotency.

5. P **Hasanzadeh H** *et al*, (October 2014) *Effect of ELF-EMF Exposure on Human Neuroblastoma Cell Line: a Proteomics Analysis*, Iran J Cancer Prev. 2014 Winter;7(1):22-7. [View Author's abstract conclusions] [View on Pubmed]

Extremely low frequency electromagnetic fields (ELF-EMF) have been common in daily life all over the world. They have produced by power lines and electrical appliances, but higher levels of them have raised a lot of concerns about their carcinogenesis. Both epidemiological and laboratory studies have suggested that EMFs might increase cancer incidence, including acute childhood leukemia, brain and breast cancer. In the present study, SH-SY5Y human neuroblastoma cell line has exposed to 2mT, 50 Hz magnetic field for 3 h. Next, effect of this exposure on protein expression including over-expression or under-expression has assessed by proteomics. Bioinformatics and statistical analysis using progenesis same spot software on the obtained 2D electrophoresis has shown that expression of 189 proteins in exposed group has changed relative to control. Besides, PCA analysis has verified results of clustering, and has shown that protein data has clustered according to experimental conditions. The results of this study have shown that ELF-EMF changes cell morphology via altering protein expression, but more profound studies have needed to determine the kind of proteins altered.

6. P **Bayat PD** *et al*, (November 2012) *Effects of prenatal exposure to extremely low electro-magnetic field on in vivo derived blastocysts of mice*, Iran J Reprod Med. 2012 Nov;10(6):555-60 [View Author's abstract conclusions] [View on Pubmed]

Indisputable population exposure to widespread electromagnetic fields, has grown concerns over the probable health effects of these fields. The present study was aimed to examine the possible effects of 50 Hz extremely low frequency electromagnetic field (ELF-EMF) exposure on the number and quality of mice blastocysts. In present study, 66 NMRI pregnant females divided into two treated and non-treated groups. The treated group exposed to ELF-EMF (50 Hz and 6x10(-3) T). Subsequently, embryos were collected by flushing the uterine horn and Fallopian tubes on the day 3 of gestation. Number of trophoectoderm (TE) and Inner Cell Mass (ICM) cells in blastocysts were determined after differential nuclei staining using a modified method. Furthermore, number of all flushed blastocysts calculated in each group. There was no significant difference in mean number of blastocysts in treated (6.64±1.34) and none treated (8.22±1.59) groups. In treated group, there were significant decreased in total cell number of blastocysts (p=0.000), number of ICM cells (p=0.000), and number of TE cells (p=0.001) whereas the ratio of ICM/TE cells increased (p=0.002). The data indicate that ELF-EMF is able to affect cellular composition of blastocysts, but it can't omit total volume of blastocysts.

7. - **Vijayalaxmi, Prihoda TJ**, (April 2014) *Mobile phones, non-ionizing radiofrequency fields and brain cancer: is there an adaptive response?*, Dose Response. 2014 Apr 22;12(3):509-14. doi: 10.2203/dose-response.14-012.Vijayalaxmi. eCollection 2014 [View Author's abstract conclusions] [View on Pubmed]

There is widespread concern among the general public regarding the ever increasing use of mobile phones. The concern is mainly because the antenna which transmits nonionizing radiofrequency fields is held close to the head during use and thus might cause brain cancer. By far, the largest epidemiological study was conducted by the INTER-PHONE study group and the results were published in 2011. The author's conclusions were (i) no increased risk of meningioma and glioma in mobile phone users and (ii) there were suggestions of an increased risk for glioma at the highest exposure levels but, bias and error prevented a causal interpretation. We have carefully examined all of the odd ratios presented in the INTERPHONE study publication: our results showed 24.3% decreased and 0.7% increased risk for meningioma and 22.1% decreased and 6.6% increased risk for glioma. Hence, we hypothesize that the overwhelming evidence for the decreased risk for both diseases may be due to the induction of 'adaptive response' which is well-documented in scientific literature.

8. N **Klose M** *et al*, (October 2014) *Effects of Early-Onset Radiofrequency Electromagnetic Field Exposure (GSM 900 MHz) on Behavior and Memory in Rats*, Radiat Res. 2014 Oct;182(4):435-47. doi: 10.1667/RR13695.1. Epub 2014 Sep 24 [View Author's abstract conclusions] [View on Pubmed]

Female Wistar rats, from an age of 14 days to 19 months, were exposed in the head region for 2 h per day, 5 days per week, to a GSM-modulated 900 MHz radiofrequency electromagnetic field (RF-EMF). The average specific absorption rates (SAR) in the brain were 0 (sham), 0.7, 2.5 and 10 W/kg. To ensure a primary exposure of the head region, rats were fixed in restraining tubes of different sizes according to their increasing body weight. During the experiment, a set of 4 behavioral and learning tests (rotarod, Morris water maze, 8-arm radial maze, open field) were performed 3 times in juvenile, adult and presenile rats. In these tests, no profound differences could be identified between the groups. Only presenile rats of the cage control group showed a lower activity in two of these tests compared to the other groups presumably due to the lack of daily handling. The rotarod data revealed on some testing days significantly longer holding times for the sham-exposed rat vs. the exposed rat, but these findings were not consistent. During the first year, body weights of sham-exposed and exposed rats were not different from those of the cage controls, and thereafter only marginally lower, so that the effect of stress as confounder was probably negligible. The results of this study do not indicate harmful effects of long-term RF-EMF exposure even when begun at an early age on subsequent development, learning skills and behavior in rats, even at relatively high SAR values.

9. P **Movvahedi MM** *et al*, (May 2014) *Does exposure to GSM 900 MHz mobile phone radiation*

affect short-term memory of elementary school students?, J Pediatr Neurosci. 2014 May;9(2):121-4. doi: 10.4103/1817-1745.139300 [View Author's abstract conclusions] [View on Pubmed]

Now-a-days, children are exposed to mobile phone radiation at a very early age. We have previously shown that a large proportion of children in the city of Shiraz, Iran use mobile phones. Furthermore, we have indicated that the visual reaction time (VRT) of university students was significantly affected by a 10 min real/sham exposure to electromagnetic fields emitted by mobile phone. We found that these exposures decreased the reaction time which might lead to a better response to different hazards. We have also revealed that occupational exposures to radar radiations decreased the reaction time in radar workers. The purpose of this study was to investigate whether short-term exposure of elementary school students to radiofrequency (RF) radiation leads to changes in their reaction time and short-term memory. A total of 60 elementary school children ages ranging from 8 to 10 years studying at a public elementary school in Shiraz, Iran were enrolled in this study. Standardized computer-based tests of VRT and short-term memory (modified for children) were administered. The students were asked to perform some preliminary tests for orientation with the VRT test. After orientation, to reduce the random variation of measurements, each test was repeated ten times in both real and sham exposure phases. The time interval between the two subsequent sham and real exposure phases was 30 min. The mean ± standard deviation reaction times after a 10 min talk period and after a 10 min sham exposure (switched off mobile) period were 249.0 ± 82.3 ms and 252.9 ± 68.2 ms (P = 0.629), respectively. On the other hand, the mean short-term memory scores after the talk and sham exposure periods were 1062.60 ± 305.39, and 1003.84 ± 339.68 (P = 0.030), respectively. To the best of our knowledge, this is the first study to show that short-term exposure of elementary school students to RF radiation leads to the better performance of their short-term memory.

10. N **Rosado MM** *et al*, (September 2014) *Effects of GSM-modulated 900 MHz radiofrequency electromagnetic fields on the hematopoietic potential of mouse bone marrow cells*, Bioelectromagnetics. 2014 Sep 25. doi: 10.1002/bem.21880. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

Studies describing the influence of radiofrequency electromagnetic fields on bone marrow cells (BMC) often lack functional data. We examined the effects of in vivo exposure to a Global System for Mobile Communications (GSM) modulated 900 MHz RF fields on BMC using two transplantation models. X-irradiated syngeneic mice were injected with BMC from either RF-field-exposed, sham-exposed or cage control mice. Twelve weeks after transplantation, no differences in thymocyte number, frequency of subpopulations and cell proliferation were found in mice receiving BMC from either group. Also, in the spleen cell number, percentages of B/T cells, B/T-cell proliferation, and interferon γ (IFN-γ) production were similar in all groups. In parallel, a mixture of BMC from congenic sham- and RF-exposed mice were co-transplanted into lymphopenic Rag2 deficient mice. BMC from RF-exposed and sham-exposed mice displayed no advantage or disadvantage when competing for the replenishment of lymphatic organs with mature lymphocytes in Rag2 deficient mice. This model revealed that BMC from sham-exposed and RF-exposed mice were less efficient than BMC from cage control mice in repopulating the thymus, an effect likely due to restraint stress. In conclusion, our results showed no effects of in vivo exposure to GSM-modulated RF-fields on the ability of bone marrow (BM) precursors to long-term reconstitute peripheral T and B cell compartments.

11. N **Dasdag S** *et al*, (September 2014) *Effect of Long Term 900 MHz Radiofrequency Radiation on Enamel Microhardness of Rat's Teeth*, Oral Health Dent Manag. 2014 Sep;13(3):749-52 [View Author's abstract conclusions] [View on Pubmed]

Oral tissues are important parts of body that absorbs radiation emitted from mobile phones which is the most popular technological equipment in the world. Because of the limited studies in this field, we aimed to investigate the effect of Radio Frequency (RF) radiation emitted from 900 MHz mobile phones on the enamel micro hardness of rat teeth. The study was carried out on twenty one Wistar Albino adult male rats which were divided into two groups such as control and

experiment groups. For the study group (n: 14), rats exposed to the radiation 2 h per day (7 days in a week) for 10 months. For the control group (n: 7), rats were placed into the carousel and the same procedure was applied except that the generator was turned off. At the end of the study, enamel micro hardness of rat's teeth was measured. The results of this study showed that 900 MHz RF radiation did not alter the enamel micro hardness of rats' teeth ($p > 0.05$). Exposure of 900 MHz RF radiation for 2 hours per day during ten months does not alter enamel micro hardness of rats' teeth. However, further studies are necessary to clarify this topic.

12. - **Sadetzki S** *et al*, (September 2014) *The MOBI-Kids Study Protocol: Challenges in Assessing Childhood and Adolescent Exposure to Electromagnetic Fields from Wireless Telecommunication Technologies and Possible Association with Brain Tumor Risk*, Front Public Health. 2014 Sep 23;2:124. doi: 10.3389/fpubh.2014.00124. eCollection 2014 [View Author's abstract conclusions] [View on Pubmed]

The rapid increase in mobile phone use in young people has generated concern about possible health effects of exposure to radiofrequency (RF) and extremely low frequency (ELF) electromagnetic fields (EMF). MOBI-Kids, a multinational case-control study, investigates the potential effects of childhood and adolescent exposure to EMF from mobile communications technologies on brain tumor risk in 14 countries. The study, which aims to include approximately 1,000 brain tumor cases aged 10-24 years and two individually matched controls for each case, follows a common protocol and builds upon the methodological experience of the INTERPHONE study. The design and conduct of a study on EMF exposure and brain tumor risk in young people in a large number of countries is complex and poses methodological challenges. This manuscript discusses the design of MOBI-Kids and describes the challenges and approaches chosen to address them, including: (1) the choice of controls operated for suspected appendicitis, to reduce potential selection bias related to low response rates among population controls; (2) investigating a young study population spanning a relatively wide age range; (3) conducting a large, multinational epidemiological study, while adhering to increasingly stricter ethics requirements; (4) investigating a rare and potentially fatal disease; and (5) assessing exposure to EMF from communication technologies. Our experience in thus far developing and implementing the study protocol indicates that MOBI-Kids is feasible and will generate results that will contribute to the understanding of potential brain tumor risks associated with use of mobile phones and other wireless communications technologies among young people.

13. - **Stormer FC** *et al*, (September 2014) *Is magnetite a universal memory molecule?*, Med Hypotheses. 2014 Sep 6. pii: S0306-9877(14)00312-0. doi: 10.1016/j.mehy.2014.08.028. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

Human stem cells possess memory, and consequently all living human cells must have a memory system. How memory is stored in cells and organisms is an open question. Magnetite is perhaps the best candidate to be a universal memory molecule. Magnetite may give us a clue, because it is the Earth's most distributed and important magnetic material. It is found in living organisms with no known functions except for involvement in navigation in some organisms. In humans magnetite is found in the brain, heart, liver and spleen. Humans suffer from memory dysfunctions in many cases when iron is out of balance. Anomalous concentrations of magnetite is known to be associated with a neurodegenerative disorder like Alzheimer's disease. Due to the rapid speed and accuracy of our brain, memory and its functions must be governed by quantum mechanics.

14. N **Korr H** *et al*, (October 2014) *No Evidence of Persisting Unrepaired Nuclear DNA Single Strand Breaks in Distinct Types of Cells in the Brain, Kidney, and Liver of Adult Mice after Continuous Eight-Week 50 Hz Magnetic Field Exposure with Flux Density of 0.1 mT or 1.0 mT*, PLoS One. 2014 Oct 10;9(10):e109774. doi: 10.1371/journal.pone.0109774. eCollection 2014 [View Author's abstract conclusions] [View on Pubmed]

It has been hypothesized in the literature that exposure to extremely low frequency electromagnetic fields (50 or 60 Hz) may lead to human health effects such as childhood

leukemia or brain tumors. In a previous study investigating multiple types of cells from brain and kidney of the mouse (Acta Neuropathologica 2004; 107: 257-264), we found increased unrepaired nuclear DNA single strand breaks (nDNA SSB) only in epithelial cells of the choroid plexus in the brain using autoradiographic methods after a continuous eight-week 50 Hz magnetic field (MF) exposure of adult mice with flux density of 1.5 mT. In the present study we tested the hypothesis that MF exposure with lower flux densities (0.1 mT, i.e., the actual exposure limit for the population in most European countries, and 1.0 mT) shows similar results to those in the previous study. Experiments and data analysis were carried out in a similar way as in our previous study. Continuous eight-week 50 Hz MF exposure with 0.1 mT or 1.0 mT did not result in increased persisting unrepaired nDNA SSB in distinct types of cells in the brain, kidney, and liver of adult mice. MF exposure with 1.0 mT led to reduced unscheduled DNA synthesis (UDS) in epithelial cells in the choroid plexus of the fourth ventricle in the brain (EC-CP) and epithelial cells of the cortical collecting duct in the kidney, as well as to reduced mtDNA synthesis in neurons of the caudate nucleus in the brain and in EC-CP. No evidence was found for increased persisting unrepaired nDNA SSB in distinct types of cells in the brain, kidney, and liver of adult mice after continuous eight-week 50 Hz magnetic field exposure with flux density of 0.1 mT or 1.0 mT.

15. P **Carlberg M, Hardell L**, (October 2014) *Decreased Survival of Glioma Patients with Astrocytoma Grade IV (Glioblastoma Multiforme) Associated with Long-Term Use of Mobile and Cordless Phones*, Int J Environ Res Public Health. 2014 Oct 16;11(10):10790-10805 [View Author's abstract conclusions] [View on Pubmed]

On 31 May 2011 the WHO International Agency for Research on Cancer (IARC) categorised radiofrequency electromagnetic fields (RF-EMFs) from mobile phones, and from other devices that emit similar non-ionising electromagnetic fields, as a Group 2B, i.e., a "possible", human carcinogen. A causal association would be strengthened if it could be shown that the use of wireless phones has an impact on the survival of glioma patients. We analysed survival of 1678 glioma patients in our 1997-2003 and 2007-2009 case-control studies. Use of wireless phones in the >20 years latency group (time since first use) yielded an increased hazard ratio (HR) = 1.7, 95% confidence interval (CI) = 1.2-2.3 for glioma. For astrocytoma grade IV (glioblastoma multiforme; n = 926) mobile phone use yielded HR = 2.0, 95% CI = 1.4-2.9 and cordless phone use HR = 3.4, 95% CI = 1.04-11 in the same latency category. The hazard ratio for astrocytoma grade IV increased statistically significant per year of latency for wireless phones, HR = 1.020, 95% CI = 1.007-1.033, but not per 100 h cumulative use, HR = 1.002, 95% CI = 0.999-1.005. HR was not statistically significant increased for other types of glioma. Due to the relationship with survival the classification of IARC is strengthened and RF-EMF should be regarded as human carcinogen requiring urgent revision of current exposure guidelines.

16. – **Liorni I** *et al*, (September 2014) *Dosimetric study of fetal exposure to uniform magnetic fields at 50 Hz*, Bioelectromagnetics. 2014 Sep 29. doi: 10.1002/bem.21878. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

In this paper, fetal exposure to uniform magnetic fields (MF) with different polarizations is quantified at 50 Hz. Numerical computations were performed on high-resolution pregnant models at 3, 7, and 9 months of gestational age (GA), that distinguish a high number of fetal tissues. Fetal whole-body and tissue-specific induced electric fields (E) and current densities (J) were analyzed as a function of both the extremely low frequency magnetic field (ELF-MF) polarization and GA. Additionally, the induced field variation due to changes in fetal position was analyzed by means of two new pregnant models. The uncertainty budget due to the grid resolution was also calculated. Finally, the compliance of the fetal exposure to the ICNIRP Guidelines was checked. A fetal exposure matrix was built at 50 Hz, which could be used to further investigate possible interaction mechanisms between ELF-MF and the associated health risk. Some specific findings were: (1) the induced fields increased with GA; (2) the maxima E were found in skin and fat tissues at each GA; (3) fetal tissue-specific exposure was modified as a function of GA and polarization; (4) the change of the fetal position in the womb significantly modified the induced E in some fetal tissues; (5) the induced fields were in compliance with ICNIRP Guidelines and the results were quite below the permitted threshold limit.

17. [N] **Bamiou DE** *et al*, (September 2014) *Mobile telephone use effects on perception of verticality.*, Bioelectromagnetics. 2014 Sep 26. doi: 10.1002/bem.21877. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

Low-level radiofrequency (RF) signals may produce disorientation and nausea. In experiment I, we assessed mobile phone effects on graviception in nine symptomatic subjects after mobile telephone use and 21 controls. The mobile handset was strapped to each ear for 30 min in pulsed emission, continuous RF emission, or no emission test mode, respectively. The subjective visual vertical and horizontal (SVV/SVH) were tested from min 25 of exposure. There was no exposure effect; however, there was an ear effect, with the SVV/SVH being shifted to the opposite direction of the ear exposed. This could be due to thermal or RF effects or handset weight. In experiment II, we assessed the handset weight effect on 18 normal controls. After baseline SVV/SVH, the switched off handset was strapped to either ear; the SVV/SVH was repeated 25 min later. A significant ear effect was found. We compared the observed ear effect SVV/SVH change in the experiment II group to the continuous exposure ear effect change in the experiment I group, and the difference was not significant. The ear effect was attributed to a minor head tilt due to the handset weight, or proprioceptive stimulation of neck muscle affecting the perception of verticality.

18. [-] **Li C** *et al*, (January 2015) *Generation of infant anatomical models for evaluating electromagnetic field exposures*, Bioelectromagnetics. 2015 Jan;36(1):10-26. doi: 10.1002/bem.21868. Epub 2014 Oct 18 [View Author's abstract conclusions] [View on Pubmed]

Realistic anatomical modeling is essential in analyzing human exposure to electromagnetic fields. Infants have significant physical and anatomical differences compared with other age groups. However, few realistic infant models are available. In this work, we developed one 12-month-old male whole body model and one 17-month-old male head model from magnetic resonance images. The whole body and head models contained 28 and 30 tissues, respectively, at spatial resolution of 1 mm x 1 mm x 1 mm. Fewer identified tissues in the whole body model were a result of the low original image quality induced by the fast imaging sequence. The anatomical and physical parameters of the models were validated against findings in published literature (e.g., a maximum deviation as 18% in tissue mass was observed compared with the data from International Commission on Radiological Protection). Several typical exposure scenarios were realized for numerical simulation. Dosimetric comparison with various adult and child anatomical models was conducted. Significant differences in the physical and anatomical features between adult and child models demonstrated the importance of creating realistic infant models. Current safety guidelines for infant exposure to radiofrequency electromagnetic fields may not be conservative.

19. [P] **Raus Balind** *et al*, (October 2014) *Short- and long-term exposure to alternating magnetic field (50 Hz, 0.5 mT) affects rat pituitary ACTH cells: Stereological study*, Environ Toxicol. 2014 Oct 27. doi: 10.1002/tox.22059. [Epub ahead of print] [View Author's abstract conclusions] [View on Pubmed]

The aim of the present study was to determine does extremely low frequency magnetic field (ELF-MF, 50 Hz, 0.5 mT) affect pituitary adrenocorticotroph (ACTH) cells in adult animals. We performed two series of experiments: (1) short-term exposure of 3-month-old rats to ELF-MF for 1 and 7 days, and (2) long-term exposure of rats to ELF-MF from their conception to 3 months of age. Stereological study was performed on immunolabeled pituitary ACTH cells. The total number and volume of ACTH cells, the volume of their nuclei and pituitary volume were measured. ELF-MF exposure for 1 day significantly decreased total number and volume of ACTH cells, the volume of their nuclei, as well as pituitary volume. ELF-MF exposure for 7 days significantly reduced only the volume of ACTH cells. Life-long exposure to ELF-MF induced decrease in the volume of ACTH cells and pituitary volume. We can conclude that the applied ELF-MF has a strong influence on morphometrical parameters of the pituitary ACTH cells and could be considered as a stressogenic factor.

20. P **Zong C** *et al*, (March 2015) *Adaptive response in mice exposed to 900 MHZ radiofrequency fields: Bleomycin-induced DNA and oxidative damage/repair*, Int J Radiat Biol. 2015 Mar;91(3):270-6. doi: 10.3109/09553002.2014.980465. Epub 2015 Jan 27 [View Author's abstract conclusions] [View on Pubmed]

The purpose of this study was to determine whether mice exposed to radiofrequency fields (RF) and then injected with a radiomimetic drug, bleomycin (BLM), exhibit adaptive response and provide some mechanistic evidence for such response. Adult mice were exposed to 900 MHz RF at 120 μW/cm(2) power density for 4 hours/day for 7 days. Immediately after the last exposure, some mice were sacrificed while the others were injected with BLM 4 h later. In each animal: (i) The primary DNA damage and BLM-induced damage as well as its repair kinetics were determined in blood leukocytes; and (ii) the oxidative damage was determined from malondialdehyde (MDA) levels and the antioxidant status was assessed from superoxide dismutase (SOD) levels in plasma, liver and lung tissues. There were no indications for increased DNA and oxidative damages in mice exposed to RF alone in contrast to those treated with BLM alone. Mice exposed to RF+ BLM showed significantly: (a) reduced BLM-induced DNA damage and that remained after each 30, 60, 90, 120 and 150 min repair time, and (b) decreased levels of MDA in plasma and liver, and increased SOD level in the lung. The overall data suggested that RF exposure was capable of inducing adaptive response and mitigated BLM- induced DNA and oxidative damages by activating certain cellular processes.