COMMISSION K: ELECTROMAGNETICS IN BIOLOGY AND MEDICINE
(November 2010 – October 2013)

Edited by Watanabe S, Sekino M, Ikehata M, Yoshie S, Taki M and Jimbo Y

Introduction

The research activities on the biological effects of electromagnetic fields in Japan from 2010 to 2013 are reviewed. *In vivo*, *in vitro*, dosimetrical studies on DC electric and magnetic fields, extremely low frequency (ELF) electric and magnetic fields, intermediate frequency (IF) magnetic fields, radio frequency (RF) and microwaves are discussed. Biomedical applications including magnetic stimulation, hyperthermia, thermal ablation, MEG, MCG, current distribution MRI, fMRI and radiometry, contactless power transmission, and electromagnetic interference (EMI) are also introduced.

K1 Biological Effects of Electromagnetic Fields

K1.1 Static magnetic field

Japanese researchers focused on biological effects of moderate static magnetic field for possible medical application and also health risk assessment of ultra-high static magnetic field.

K1.1.1 *In vivo* studies

Xu *et al*., reported effects of moderate static magnetic field on impaired peripheral vasomotion. *In vivo* ischemia model by caudal artery ligation was used. They implanted a magnetized rod (max. 160 mT) into the middle diaphysis of the fifth caudal vertebra. NIRS measurements were performed in 3- , 5- , and 7-week sessions and the vasomotion amplitude and frequency were analyzed. As the result, exposure for 3-7 weeks to the SMF significantly contracted the increased vasomotion amplitude in the ischemic area. These results suggest that SMF may have a regulatory effect on rhythmic vasomotion in the ischemic area by smoothing the vasomotion amplitude in the early stage of the wound healing process [Xu *et al*., 2013].

Okano was involved various research for exploring effects of moderate static magnetic field on peripheral vasomotion (above study), nerve conduction, bone mineralization, pain relief and hypertension [Okano *et al*., 2012; Xu *et al*., 2011; Kanai *et al*., 2011; Nishimura *et al*., 2011] .

Yamaguchi-Sekino *et al*. [2012] investigated effects of acute exposure to ultra-high static magnetic field (17.2 T) on brain blood barrier. Six SD rats (7-9 weeks) were exposed at 17.2 T for 3 hours under anesthesia. Blood gas analysis of arterial blood at 1.5 hours after the beginning of the exposure and examination of BBB permeability by injection of Evans blue under exposure were carried out. The entire brains and the slices were observed via stereomicroscope. No differences were detected from macroscopic observation, blood gas analysis, and Evans blue concentration between the two groups. Therefore, they concluded that acute exposure (up to 3 hours) to ultra-high magnetic field (17.2 T) does not alter BBB permeability.

K1.1.2 *In vitro* studies

Okano evaluated the effect of SMF up to 0.7 T on the membrane excitation and refractory processes of sciatic nerve fibres of Xenopus frogs. The compound action potentials (CAP) values were measured for two groups, the control group and the SMF-exposed group for 6 h. The conduction velocity of C fiber was significantly delayed by not 0.25 T but 0.7 T SMF exposure for 4–6 h compared with the unexposed control group. They suggest that these results imply that an SMF may diminish pain perception because the C fiber is responsible for pain transmission. [Okano, 2011].

K1.1.3 Other studies

Effect of gradient static magnetic field on unstirred Belousov-Zhabotinsky reaction was investigated by Okano *et al.* [2013]. The ferroin-catalyzed BZ medium was exposed to the SMF for up to 16 min at 25 degrees C. The experiments demonstrated that the wave velocity was significantly accelerated primarily by the magnetic gradient. The propagation of the fastest wave front indicated a sigmoid increase along the peak magnetic gradient line, but not along the peak magnetic force product line. The underlying mechanisms of the SMF effects on the anomalous wave propagation could be attributed primarily to the increased concentration gradient of the paramagnetic iron ion complexes at the chemical wave fronts induced by the magnetic gradient.

Yamaguchi-Sekino *et al*. [2011] investigated magnetic field in working environment of shielded-arc welding. They measured the magnetic field exposure level of welders in the course of working. The measurements were performed using a 3-axis Hall magnetometer attached to a subject's wrist and data was collected every 5 s from the beginning of the work time to the end. Data showed dominant is DC magnetic field and the maximum exposed field was 0.35–3.35 mT and the average value per day was 0.04–0.12 mT. They also conducted a finite element method-based analysis of human hand tissue for the electromagnetic field dosimetry. Calculated eddy current (4.28 mA/m^2) was much lower than the well-known guideline thresholds for electrical nerve or muscular stimulation.

K1.2 Extremely Low Frequency (ELF) magnetic field

Research activity of this field is not high during last three years. Time-varying 1.5 T magnetic field on cell regulation, *in vitro* nerve stimulation method by ELF magnetic field, theoretical study of body hair movement by ELF electric field and follow-up study of epidemiological findings were reported.

K1.2.1 *In vivo* studies

Takahashi *et al*. [2012] established and evaluated the toxic response of human-like hematopoietic lineage in NOG mice to a representative toxic agent, benzene. They compared of responses to the toxic effects of benzene with mouse chimeric-NOG and found there were greater response in lymphoid cells than in myeloid cells in Mo-NOG and Hu-NOG mice. They have a plan to use this mouse lineage to evaluate possible effect of ELF-MF on leukemia that was reported in several epidemiological studies.

K1.2.2 *In vitro* studies

Nishisako *et al*. [2011] reported effects of a 1.5 T time-varying magnetic field on cell volume regulation of bovine adrenal chromaffin cells in hyposmotic media.

Ikehata *et al*. [2010] reported effects of exposure to a time-varying 1.5 T magnetic field on the neurotransmitter-activated increase in intracellular Ca^{2+} in relation to actin fiber and mitochondrial functions in bovine adrenal chromaffin cells.

Saito *et al*. [2011] reported establishment of precise magnetic stimulation. They developed a Mu-metal based localized magnetic stimulation (LMS) system with micro-fabricated dual cell-culture chambers combining with a microelectrode array (MEA) permitted the evaluation of the stimulus effects at the stimulated and non-stimulated sites. They arranged cell-culture chambers in a concentric circle manner and rat cortical neurons were separately cultured in outer and inner chambers. Mu-metal was aligned along the outer circle, which allowed us of focal magnetic stimulation to the cells in the outer chamber. Applying low frequency magnetic field to the Mu-metal caused to induce currents and the electrical activity of the cells in the outer chamber was modified depending on the stimulation intensity. Following the modified activity in the outer circles, the cells in the inner chamber also showed slightly depressed activity patterns.

K1.2.3 Epidemiological studies

Schüz *et al*. (involved Hagihara J, Saito AM) [2012] reported follow up study of previous epidemiological findings. Data from 3073 cases of childhood ALL were pooled from prospective studies conducted in Canada, Denmark, Germany, Japan, UK and US to determine death or relapse up to 10 years from diagnosis. Adjusting for known prognostic factors, we calculated hazard ratios (HRs) and 95% confidence intervals (CI) for overall survival and event-free survival for ELF-MF exposure categories and by 0.1 μT increases. The HRs by 0.1 μT increases were 1.00 (CI, 0.93-1.07) for event-free survival analysis and 1.04 (CI, 0.97-1.11) for overall survival. ALL cases exposed to >0.3 μT did not have a poorer event-free survival (HR=0.76; CI, 0.44-1.33) or overall survival (HR=0.96; CI, 0.49-1.89). HRs varied little by subtype of ALL. In conclusion, ELF-MF exposure has no impact on the survival probability or risk of relapse in children with ALL. Sato AM contributed to this study.

K1.2.4 Other studies

Shimizu *et al*. [2013a, 2013b] reported theoretical studies movement of body hair by ELF electric fields. To elucidate the mechanism of the biological effect of ELF (extremely low frequency, 0–300 Hz) electric field and to settle appropriate safety standards, the body hair movement in AC electric field exposure was analyzed. They derived the equation of motion to describe the body hair movement cause by the electric force, and obtained an analytic solution for AC input. They applied this solution to practical conditions and clarified the body hair movement in AC electric field exposure. Using this solution, the body hair movement in different humidity and verified the validity of the analysis in experiments was analyzed.

K1.3 Intermediate Frequency (IF) magnetic field

Research activity in this frequency range is higher than ELF. Several research groups vigorously investigated about several biological indices both *in vivo* and *in vitro* to establish data for health risk assessment.

K1.3.1 *In vivo* studies

In National Institute of Public Health, several projects have been conducted. Win-Shwe *et al*. [2013] investigated the effect of IF-MF on the expressions of memory function-related genes and related transduction molecules in the mouse hippocampus. Mice were exposed to IF-MF (21 kHz, 3.8 mT) one hour per day for 2 weeks. Twenty-four hour after final exposure, the expression levels of memory function-related genes and the mRNA levels for signal transduction pathway molecules in the hippocampi were examined using real-time RT-PCR. The relative mRNA expression levels of the N-methyl-D aspartate (NMDA) receptor subunits NR1, NR2A, and NR2B as well as transcription factors (calcium/calmodulin-dependent protein kinase (CaMK) -IV, cyclic AMP responsive element binding protein (CREB) -1) and neurotrophins (nerve growth factor (NGF), and brain-derived neurotrophic factors (BDNF)) were not significantly altered in the IF-MF-exposed mice. They also examined the morphology of the hippocampus using a histological analysis, but no changes in the IF-MF-exposed mice were observed.

Ushiyama *et al*. investigated blood properties and immune systems in rats. They exposed rats up to 3.8 mT, 21 kHz MF for 1hr per day for 3 consecutive days under fixed conditions in acrylic holder. On the 4th day following the exposure, biochemical and hematological parameters in the blood were analyzed. They also examined the effects to the immunological functions such as cytotoxic activity and phagocytotic activity. Results indicate that there is no effects to these parameters, even high magnetic flux density was exposed to the animals.

Ushiyama *et al*. [2012, 2013] investigated immunotoxicity by exposure 10.3 mT, 21 kHz MF on fetus development in rat. They developed exposure apparatus that is suitable for abdominal exposure. Pregnant rats were locally exposed to 21 kHz MF for 1 hr/day from gestation day 7 up to 17. Maximum flux density is at abdominal surface was 10.3 mT. On the gestation day 20, their fetuses were excised and weighed. The number of live fetuses, dead fetuses, and implantation sites were recorded. Then, fetuses were examined for external and internal abnormalities and also skeletons abnormalities. Results show that there is no significant difference between exposed and non-exposed group.

In CRIEPI group, Nishimura *et al*. [2011] investigated teratological effects in rats exposed to 20 or 60 kHz magnetic fields. Pregnant Crl:CD(SD) rats (25/group) were exposed to a 20 kHz, 0.2 mT (rms) or 60 kHz, 0.1 mT (rms) sinusoidal MF or sham-exposed for 22 hr/day during organogenesis, and their fetuses were examined for malformations on gestation day 20. As the result, no exposure-related changes were found in clinical signs, gross pathology, or number of implantation losses. The number of live fetuses and low-bodyweight fetuses as well as the incidence of external, visceral, and skeletal malformations in the fetuses did not indicate significant differences between MF-exposed and sham-exposed groups. Therefore, exposure of rats to MFs during organogenesis did not show significant reproducible teratogenicity under experimental conditions.

K1.3.2 *In vitro* studies

From RTRI's group, several reports of the biological effect of the intermediate frequency magnetic fields (IF-MFs) were published.

Ikehata *et al.* [2010] studied the development of novel exposure system of IF-MFs for *in vitro* test systems, which is capable of generating 20 kHz, up to 3.9 mT IF-MF within exposure space (150 mm × 150 mm × 150 mm) within ± 5 % deviation. Ikehata [2011] also reported the evaluation of mutagenic effect of IF-MF in *in vitro* micronucleus assay. The results show that up to 3.9 mT, 21 kHz IF-MF exposure for 24 hrs did not induce micronucleus in CHL/IU cells.

Yoshie *et al.* [2011] investigated the effect of IF-MF (21 kHz, 3.9 mT (rms)) on growth rate of various cell lines, which are deficient in DNA repair, and mutagenicity by HPRT mutation assay using CHO-K1 cells. The results showed that the IF-MF exposure does not affect cell growth regardless of the ability of DNA repair. In the HPRT mutation assay, the results indicated that the IF-MF exposure does not cause mutation as well. Yoshie *et al.* [2013] also reported long term IF-MF exposure on cell differentiation from embryonic stem cell to cardiomyocyte was evaluated using the Embryonic Stem Cell Test (EST). This test is a method of alternatives of animal experiment for teratology. The results show IF-MF affect neither cell proliferation nor cell differentiation in murine embryonic stem cell for 10 days exposure.

Ogasawara *et al.* [2012] investigated possible hormonal effect or effects on hormonal action by exposure to 21 kHz IF-MF using genetically modified MCF-7 cells integrated estrogen-regulated reporter gene. The results show neither hormonal effect nor effect on hormonal action by exposure up to 3.9 mT, 21 kHz IF-MF for 4 days.

In CRIEPI group, Nakasono *et al*. investigated genotoxic and promotion potentials of a vertical and sinusoidal IF MF of 0.91 mT (rms) at 2 kHz, 1.1 mT (rms) at 20 kHz and 0.11 mT (rms) at 60 kHz. They used microbial mutagenicity tests, gene conversion tests, micronucleus tests or mouse lymphoma assay for genotoxicity, and Bhas 42 promotion tests for promotion. The results indicated that the IF MFs did not have genotoxic nor promotion potentials in the experimental conditions.

K1.4 RF electromagnetic field and microwaves

K1.4.1 *In vivo* studies

Masuda *et al.* [2011] locally exposed rat's brain cortex to 2-GHz RF and evaluated the local cerebral blood flow (CBF) and temperature. They found that CBF depended on the brain cortex temperature but not on the rectal temperature in the early part of the RF exposure while CBF was correlated with the both target and rectum temperature at the end of the RF exposure (18min). They used a local exposure setup with a figure-eight loop antenna. The averaged SAR of the target tissue was set at 10.5, 40.3, 130 and 263 W/kg.

Ohtani *et al*. [2012] conducted an *in vivo* study on immunotoxic effects. They used a whole-body exposure setup using cross-dipole antennas and juvenile rats. Quantity of 6 cytokine in hematopoietic lineage cells and T cell population were analyzed with flow cytometry as first screening. The final results will be reported in near future.

K1.4.2 *In vitro* studies

Miyakoshi and his colleagues have been engaging on *in vitro* studies in RF frequency region. Sakurai *et al*. [2011] evaluated the gene expression in a human-derived glial cell exposed to 2.45 GHz continuous wave 1, 5, and 10 W/kg for 1, 4, and 24 h and concluded that no evidence that exposure to RF fields affected gene expression for their experimental condition. Miyakoshi [2013] has recently published his comprehensive review on *in vitro* studies in RF frequency region.

K1.4.3 Other studies

Nakatani-Enomoto *et al*. [2013] have conducted a human study on the quality of sleep after exposure to RF EMF from a cellular phone. They concluded that EMF exposure for 3 h from a W-CDMA-like system has no detectable effects on human sleep.

K1.5 Millimeter wave

Kanazawa Medical University (KMU) group has been engaging on ocular effects due to localized exposure to millimeter wave using rabbits. Recently they reported the threshold of the thermal effects of millimeter wave at 40 GHz and 76 GHz [Kojima *et al*, 2011, 2012; Naillia *et al*, 2012]. They also reported that the direction of the fluid convection in the anterior chamber of the eye exposed to millimeter wave changed between 40 GHz and 76 GHz and significantly affects the threshold and the target of the thermal effects,

K1.6 Contact currents

Tarao *et al*. investigated contact currents and electric fields by exposure to ELF electric fields using anatomically realistic human model. As a result, they reported in the case that a human is exposed to an electric field of 1 kV/m at 60 Hz the short-circuit current of 18 A flows though the ankles. Furthermore, the electric field of 40 mV/m in the nervous tissue of the adult model is induced by exposure to external electric fields at the reference level, which is enough smaller than the basic restrictions established in the ICNIRP guidelines for occupational exposure.

K2 Dosimetry

K2.1 Numerical dosimetry

The numerical dosimetry is very active in Japan because fine anatomical voxel human models of Japanese adults and children are available from National Institute of Information and Communications Technology (NICT). New voxel human models also recently have been developed [Nagaoka *et al*., 2012, 2013a; Nagaoka and Watanabe, 2012a]. Furthermore new pregnant woman voxel models have been developed by Japan-France cooperation [Wiart *et al*., 2011].

For the numerical calculations using the voxel human models, GPU simulators have been recently used because GPU simulators offer very effective acceleration for FDTD algorithm which is generally used for RF frequency region. Nagaoka *et al*. reported that the GPU simulators can achieve comparable computation speed with a super computer [Nagaoka and Watanabe, 2011c, 2011d, 2012b, 2013].

Using the anatomical human voxel models, detailed dosimetry has been conducted for the whole-body exposure conditions, i.e., the worst-case conditions considered in the RF safety guidelines. Asayama *et al*. [2013] reported the statistical characteristics of the whole-body averaged SAR (WBA-SAR) of a pregnant woman and child. Hirata and his colleagues, reported the WBA-SAR of human models on the ground [Hirata *et al*., 2012; Yanase *et al*, 2011].

Numerical dosimetry for the localized exposure due to body-worn wireless devices such as smart phones has also been reported [Onishi *et al*., 2012]. In addition to the hand-held wireless devices, wireless power transmission (WPT) system has become another most important source of the localized exposure. Park et al. [2012a, 2012b, 2013b] have reported that the induced in situ electric fields and SAR in the human body exposed to resonance-type WPT system operated around 10 MHz. They also found that the electric field could not be ignored even if the WPT system used magnetic resonance phenomenon. Laakso and his colleagues have also reported the numerical dosimetry for a 10-MHz band resonance type WPT system and for an electric vehicle charging system operated at 85 kHz [Laakso *et al*., 2012, 2013].

Numerical dosimetry in ELF region has also been conducted using the anatomical human voxel models. Tarao and his colleagues have been reported detailed analysis of the induced in situ electric fields in a human body exposed to ELF EMF [Hamamoto *et al*., 2011; Tarao *et al*., 2011b, 2012a, 2012c, 2013a, 2013b, 2013c, 2013d].

K2.2 Experimental dosimetry

In Japan, several groups have been engaging on the development of measurement methods for WBA-SAR. Kawamura *et al.* [2012] has developed a WBA-SAR measurement system measuring the scattered E-field from the human body or phantom around 360 degrees. NICT group has also reported different measurement methods using a human-equivalent antenna and calorimetory [Ito *et al.*, 2011; Simba *et al.*, 2011; Akiyama *et al.*, 2012].

Ishii and his colleagues have been engaging on a novel calibration method for SAR probes using a small antenna in the tissue-equivalent liquid used for compliance tests of cellular phones and so on [Ishii *et al.*, 2011, 2012; Toyoshima *et al.*, 2012]. Sato *et al.* [2013] has proposed an improved calibration of a magnetic field sensor. Le *et al.* [2012], has reported the requirement for the SAR measurement of a MIMO transmitter and determined the uncertainty due to the averaging time.

K2.3 Development of exposure setups and dosimetry for medical and biological studies.

Localized exposure of laboratory animals is a technical challenge in RF engineering because the wavelength or resonant dimension is generally comparable with the small animals such as rats or mice. Arima and his colleagues have been engaging on the development of the exposure setup for *in vivo* studies on localized RF exposure of a rat's head using a figure-8 loop antenna [Arima *et al.*, 2011; Kawai *et al.*, 2011]. They also recently developed a multiband antenna for simultaneous multi-frequency exposure [Shiraishi *et al.*, 2011]. Suzuki and his colleagues have been conducted detailed analysis of the rabbit eye local exposure to millimeter wave [Koike *et al.*, 2011; Suzuki *et al.*, 2012].

Another technical challenge is the whole-body exposure to freely moving animals. The statistical analyses of such exposure conditions were reported [Wang *et al.*, 2011, 2012, 2013]. A hybrid methods was also applied for the statistical analyses for a reverberation chamber exposure setup in which rats were exposed [Chakarothai *et al.*, 2012, 2013a]. The hybrid method is also used for the numerical dosimetry of the rabbit eye localized exposure [Chakarothai *et al.*, 2013b].

Shiina *et al.* [2012] has developed an exposure setup for *in vitro* studies on biological effects of the millimeter wave. The exposure system consists of the disc-shaped post-wall waveguide and high-efficiency temperature control devices. For a human study on sleep effects of cellular phones, an exposure system was developed and detailed exposure analyses were conducted [Simba *et al.*, 2011]. Hirai *et al.* [2011] developed an *in vivo* exposure setup for intermediate frequency (IF) region. Dosimetric studies for epidemiology of cellular-phone use and cancers, i.e., INTERPHONE and Mobi-kids, have also been conducted by Japanese researchers with cooperation of researchers of other countries [Cardis *et al.*, 2011; Deltour *et al.*, 2011; Taki and Wake, 2012; Wake *et al.*, 2011].

K2.4 Mechanism between biological tissues and EMF.

Dielectric properties of biological tissues and organs are crucial parameters for the dosimetry. Although Gabriel's Cole-Cole models have been widely used, further studies on expansion or improvement of the database have been conducted in Japan. Hamaji *et al.* [2011] developed the waveguide-penetration method for the dielectric measurement and reported *in vivo* measurement of actual human fingers. Sakai *et al.* [2010] proposed a temperature compensation technique of complex permittivities of biological tissues and organs from 5 GHz to 50 GHz. Wakatsuchi *et al.* [2012] has also reported the complex permittivities of the crystalline lens from 0.5 GHz to 50 GHz using their-own original freeze-dry preparation technique. Sasaki *et al.*, has developed a dielectric measurement system using a lens antenna over 100 GHz while Gabriel did measure up to 20 GHz [Sasaki *et al.*, 2010] and also proposed a new parametric models for interpolation and extrapolation of the measured dielectric data of the biological tissues and organs [Sasakai *et al.*, 2013].

Tarao and his colleagues have been investigating the human-body equivalent impedance from ELF, which is an important parameter for a compliance procedure of contact current [Hayashi *et al.*, 2013; Tarao *et al.*, 2010, 2011a, 2012b].

In view of the thermal effects, the relationship between the SAR and the temperature elevation is the most important issue in RF dosimetry. Hirata and his colleagues reported the detailed characteristics and dominant factors for the temperature elevation of a human body and of a laboratory animal [Hirata *et al*., 2011; Kanai *et al*., 2010; Oizumi *et al*., 2013; Onishi *et al*., 2010].

Positive health effects by electric field have been investigated and some health care equipment using the electric field has been commercially available in Japan. Shimizu and her colleagues conducted theoretical analyses of body-hair movement in ELF electric field cause by the health care equipment [Iida *et al*., 2013; Shimizu *et al*., 2013].

The last study dedicated for the mechanism in Japan was the investigation in the multi reflection effects in a metallic wall such as being in an elevator. Simaba *et al*. [2011] has reported the effects of the multi reflection of RF wave from a cellular phone near a metallic wall experimentally and numerically.

K2.5 Dosimetry for medical application (see also K3)

Enhancement of the SAR around an implanted medical device or metallic object has been investigated. Endo and his colleagues, [Endo *et al*., 2011, 2012a, 2012b, 2013; Saito *et al*., 2011a, 2011b, 2012] reported the increased SAR in the front of the implanted cardiac pacemaker during the use of a cellular phone. Kawamura *et al*., [2012] also reported the local SAR around an implanted metal plates in a human body exposed to UHF EMF.

The other important aspect of the medical implant is the electromagnetic interferences (EMI). There have been numerous studies in Japan because public concerns on this issue is high: The cellular phone must be switched off near priority seats in commune trains in Japan. Endo and his colleagues investigated the EMI of an implanted cardiac pacemaker by a cellular phone using an anatomical human voxel model and an experimental phantom [Endo *et al*., 2013]. Higashiyama *et al*. [2011c, 2012] and Hikage *et al*. [2011] reported the EMI of an implantable pacemaker from a cellular phone in an elevator cabin. Hikage *et al*. also reported the EMI of an implantable pacemaker from RFID [2011d] and from a WPT system [2012, 2013]. Ishihara *et al*. [2011] reported the EMI of implanted medical devices from body area network devices. Nagase *et al*. [2012] reported the EMI of implanted medical devices from high-speed radio access technologies such as LTE. Yamanaka *et al*. [2012] reported the EMI of an implanted cardiac pacemaker of a human body existing in a nuclear fusion facility.

K3 Biomedical Applications

K3.1 Hyperthermia

Hyperthermia has been one of the most important research fields on medical application of electromagnetic fields. Microwave energy is a heating source used for localized hyperthermia. Depending on the position and size of the target tumor, several types of antennas, which radiate microwave energy to the target, can be selected. Ito and Saito [2011] introduced two types of heating schemes which can be used with microwave energy, and provided brief explanations of the basic engineering involved.

Interstitial microwave hyperthermia is one of the heating schemes and it is applied to a localized tumor. In the treatments, heating pattern control around antennas is important, especially for the treatment in and around critical organs. Saito *et al*. [2013] introduced a coaxial-dipole antenna, which is one of the thin microwave antennas and can generate a controllable heating pattern. An array of the proposed antenna generates an arbitrary shape heating patterns.

In microwave hyperthermia for bile duct carcinoma, implantation of metallic stent within the bile duct may distort the applied electromagnetic waves. Itakura *et al*. [2012] developed a biliary stent compatible with hyperthermia. Even when the probe is located inside the stent, hyperthermia can be carried out because the stent let the electromagnetic fields propagate outside through the stent. The performance of the stent was evaluated using numerical simulations and experiments.

In the hyperthermia of bile duct carcinoma, an endoscope is first inserted into the duodenum and a long and flexible coaxial antenna is then inserted into the forceps channel of the endoscope, which is used to insert the tool for surgical treatment. Then, the antenna is guided to the bile duct through the papilla of Vater, which is located in the duodenum, and is inserted in the bile duct. Tsubouchi *et al*. [2010] have an experience on animal experiment using a swine. Temperature rises around the antenna inserted into the bile duct were measured.

Clinical studies of hyperthermia are actively carried out. Aoyagi *et al*. [2012] reported a new strategy for interstitial hyperthermia based on control of a huge lymph node metastasis (>400 ml) for 2 years and 7 months.

K3.2 Therapeutic applications of electromagnetic fields

Transcranial magnetic stimulation (TMS) is a method to stimulate the brain using pulsed magnetic fields inducing eddy currents in the brain. Recent clinical studies showed that TMS is effective for the treatment of neurological and psychological diseases such as depression, Parkinson's disease, and neuropathic pain. For obtaining continuous therapeutic effect by daily TMS sessions, a concept of installing a TMS system at patient's home has been proposed. Kato *et al.* [2012] proposed a novel design of stimulator coil for inducing sufficient eddy currents in the brain at lower driving currents for the stimulator circuit. Numerical simulations based on the finite element method showed the advantages of the proposed design. A prototype coil and driving circuit were fabricated.

Xu *et al*. [2011] investigated the effects of a moderate-intensity static magnetic field on osteoporosis of the lumbar vertebrae in ovariectomized rats. A small magnet of 180 mT was implanted to the right side of spinous process of the third lumbar vertebra. The bone mineral density values of the lumbar vertebrae proximal to the exposed area significantly increased in the exposed group than in the sham group.

To examine the effectiveness of a neck-type magnetotherapeutic device (MTD) with a magnetic field of 55 mT, Kanai *et al*. [2011] performed a study of neck and shoulder pain. In MTD patients, significant pain relief was observed 3 hours after beginning treatment. Skin surface and deep body temperatures were significantly increased from the baseline values in the MTD group. These therapeutic effects were observed at 7 days after the beginning of treatment.

Nishimura *et al*. [2011] reported a study to examine the effects of repeated exposure to a 1-μT extremely low frequency fields on blood pressure in 20 humans with mild-to-moderate hypertension. There was a significant difference between the exposed and sham groups with respect to change in systolic blood pressure between baseline and the end of the exposure regimen, but not with respect to change in diastolic blood pressure.

K3.3 Magnetic resonance imaging

The state-of-the-art superconductor technology enabled us to develop ultrahigh-field magnetic resonance imaging (MRI) systems of around 10 T for humans. While these ultrahigh-field systems have advantages in visualizing neurophysiological functions in microscopic scale, the safety of ultrahigh fields are carefully investigated. Yamaguchi-Sekino *et al*. [2012] exposed animals to a 17.2 T static magnetic field, and observed no effect on the blood brain barrier.

Several novel designs of superconducting magnet for MRI have recently been proposed. Sekino *et al*. [2011] fabricated a superconducting magnet with an off-centered distribution of homogeneous magnetic field zone. They obtained MRI using a prototype magnet. This MRI will be used for a functional-MRI-based Benton visual retention test. Use of high-temperature bulk superconductor potentially realizes a portable MRI system with high magnetic fields above 2 T. Sekino *et al*. [2011] proposed an approach for homogenizing the trapped magnetic field by making concentric slits on the bulk superconductor.

The rise of the static magnetic field is proportional to the increase of the magnetic resonance frequency which brings down issues of variation in capacitance used in the radio frequency (RF) coil for MRI system. Saito *et al*. [2010] proposed an improve birdcage coil for MRI system with no lumped circuit elements.

Magnetic nanoparticles are now widely used as contrast agent for MRI. Due to the extension of the applications of magnetic nanoparticles, novel methods for detecting small amount of particles and for quantification by image processing are actively developed. Zhu, Pei, and their colleagues [2011, 2012] proposed an approach for detecting magnetic nanoparticles based on a reversed polarization of gradient magnetic field.

Optogenetics in which optically activated ion channels are genetically introduced into neurons has become a recent trend in neuroscience. The optogenetics enables us to deliver highly localized stimulation to the brain. Abe *et al*. [2012] reported functional MRI of brain activities evoked by optogenetic stimulation to the rat brain.

K3.4 Electromagnetic interference (EMI) of implanted medical devices

Due to the progress of electromagnetic susceptibility of implantable medical devices, a recently developed cardiac pacemaker lets the patient undergo an MRI scan. On the other hand, emerging technologies for wireless communication and power transmission such as smart phones, RFID, body-area network, and electric vehicles have raised novel issues on electromagnetic interference. Hikage *et al.* [2011] proposed methodological developments for assessing electromagnetic interference of implantable medical devices. Nagase *et al*. [2012] reported electromagnetic interference with medical devices from mobile phones using high-speed radio access technologies. Endo *et al*. [2012] reported an experimental evaluation of SAR around an implanted cardiac pacemaker caused by mobile radio terminal.

The risk of electromagnetic interference between mobile phones and implantable cardiac pacemakers should be carefully assessed when the patients get on an elevator cabin. Hikage, Higashiyama, and their colleagues [2011, 2012] carried out numerical and experimental evaluations for this issue.

As regards a cardiac pacemaker, it is expected that an implantable antenna will be a new tool to communicate between a cardiac pacemaker and external devices instead of conventional coils. Takahashi *et al*. [2010] designed an implantable antenna for a cardiac pacemaker to operate in 402-405 MHz band.

RFID systems also attract attention in terms of electromagnetic interference with implanted medical devices. Hikage *et al*. [2013] reported *in vitro* assessment of interference from RFID interrogator on implantable cardiac pacemakers and implantable cardioverter defibrillators.

Wireless power transmission systems have recently been put into practical use for electronic equipment such as mobile phones and electric vehicles. Hikage *et al*. [2012, 2013] investigated electromagnetic interference between active medical implants and various wireless power transmission systems.

Body area network is a new concept of communication using wearable devices. Expected applications cover a various fields such as healthcare and security. Anzai *et al.* [2012] reported the impact of spatial diversity reception on SAR reduction in implant body area networks. Ishihara *et al*. proposed a method for evaluating the electromagnetic interference of implanted medical devices from body area network devices.

Yamanaka *et al*. [2012] focused on the electromagnetic interference of cardiac pacemakers in fusion facility, and measured the leaked high-frequency burst electric field.

K3.5 Medical instrumentation

Novel healthcare applications of electromagnetic fields are widely explored. Nakajima *et al*. [2013] suggested a simple urination detection system by the RFID system. In this system, a tag is embedded into a diaper worn by a care-receiver and the care-personnel bring a reader close to the tag. In a dry diaper, the tag can communicate with the reader. However, in a wet diaper, the presented tag cannot communicate with the reader, because the characteristics of the tag antenna are changed by urination.

Yonebayashi *et al*. [2011] developed a dynamic phantom to evaluate the performance of the breath detection Doppler radar. It simulates movement of the stomach by the linear motion actuator. The authors showed the validity of the dynamic phantom by comparing it with human body.

References

Abe Y., Sekino M., Terazono Y., Ohsaki H., Fukazawa Y., Sakai S., Yawo H. and Hisatsune T. [2012], “Opto-fMRI analysis for exploring the neuronal connectivity of the hippocampal formation in rats,” Neurosci. Res. 74, pp. 248-255.

Akiyama T., Wake K., Arima T., Watanabe S., Uno T. [2012], “Whole-body averaged SAR measurements for small phantom by calorimetric method,” Proc. ISAP2012, pp.692-695, Nagoya, Japan.

Anzai D., Aoyama S., Yamanaka M. and Wang J. [2012], “Impact of spatial diversity reception on SAR reduction in implant body area networks,” IEICE Trans. Commun. E95-B (12), pp.3822-3829.

Aoyagi Y., Saito K., Horita H., Ito K., Yamazaki Y., Suzuki N., Sunakawa Y., Ogawa S., Ando N. [2012], “New strategy for interstitial hyperthermia based on control of a huge lymph node metastasis (>400ml) for 2 years and 7 months,” (in Japanese with English summary), Jpn. J. Clin. Radiol. 56, pp.1694-1702.

Arima T., Watanabe H., Wake K., Masuda H., Watanabe S., Taki M., Uno T. [2011], “Local exposure system for rats head using a figure-8 loop antenna in 1500-MHz band,” IEEE Trans. Biomedical Eng., 58, pp.2740-2747.

Asayama R., Wang J., Fujiwara O., Nagaoka T., Watanabe S. [2013], “Statistical outliers in voxel SARs and their effect of whole-body average SARs in pregnant woman and child for far-field exposure,” IEEJ Trans. A, 133, pp.7-12.

Cardis E., Varsier N., Bowmann J.D., Deltour I., Figuerola J., Mann S., Moissonier M., Taki M., Vecchia P., Villegas R., Vrijheid M., Wake K., Wiart J. [2011], “Estimation of RF energy absorbed in the brain from mobile phones in the Interphone Study,” Occup Environ Med, 68, pp.686-693.

Chakarothai J., Wang J., Fujiwara O., Wake K., Watanabe S. [2012], “Hybrid MoM-FDTD method for whole-body SAR evaluation of rat inside reverberation chamber,” KJJC2012, Seoul, Korea.

Chakarothai J., Wang J., Fujiwara O., Wake K., Watanabe S. [2013a], “Dosimetry of a reverberation chamber for whole-body exposure of small animals,” IEEE Trans. Microwave Theory and Tech., 61, pp.3435-3445.

Chakarothai J., Suzuki Y., Taki M., Wake K., Sasaki K., Watanabe S., Kojima M. [2013b], “Analysis of millimeter-wave exposure on rabbit eye using a hybrid PMCHWT-MoM-FDTD method,” Proc. ISAP2013, pp.59-62, Nanjing, China.

Deltour I., Wiart J., Taki M., Wake K., Varsier N., Mann S., Schuz J., Cardis E. [2011], “Analysis of three-dimensional SAR distributions emitted by mobile phones in an epidemiological perspective,” Bioelectromagnetics, 32, pp.634-643.

Endo Y., Takahashi M., Ito K., Saito K., Watanabe S. [2011], “Experimental evaluation on SAR around the implanted cardiac pacemaker by mobile phone,” ISABEL2011, Barcelona, Spain, October.

Endo Y., Saito K., Watanabe S., Takahashi M., and Ito K. [2012a], “Experimental evaluation of SAR around an implanted cardiac pacemaker caused by mobile radio terminal,” IEICE Trans. Commun. E95-B, pp. 2129-2132.

Endo Y., Saito K., Watanabe S., Takahashi M., Ito K. [2012b], “Evaluation of SAR around an implanted cardiac pacemaker caused by mobile radio terminal, Proc. ISAP2012, pp.680-683, Nagoya, Japan.

Endo Y., Saito K., Kojima S., Watanabe S., Takahashi M., Ito K. [2013], “Evaluation of electromagnetic interference to implanted cardiac pacemaker due to mobile phone,” Proc. ICEAA '13, pp.188-191, Torino, Italy.

Hamaji T., Kik A., Aoyagi T., Nishikata A., Watanabe S. [2011], “*In vivo* measurement of equivalent complex permittivity of fingers using the waveguide-penetration method,” IEICE Trans. Commun., J94-B, pp.1503-1507.

Hamamoto I., Hayashi N., Tarao H., and Isaka K. [2011], “Numerical investigation of contact current and internal body resistances of human at 60Hz,” APEMC 2011, No.207, Jeju, Korea, May.

Hayashi N., Tarao H., Iki Y., and Sakamoto Y. [2013], “Preliminary measurement of human body impedance at power frequency - dependence on BMI and Relative Distribution,” BioEM2013, Thessaloniki, Greece, June.

Higashiyama J., Tarusawa Y., Hikage T., Nojima T. [2011], “Experimental evaluation of implantable pacemaker EMI from mobile phone in elevator cabin,” Proc. 33rd Ann. Meet. BEMS, PA-47, Halifax, Canada, June.

Higashiyama J., Tarusawa Y., Hikage T., and Nojima T. [2012], “EMI risk assessment of electromagnetic field from mobile phone in elevator cabin for implantable pacemaker,” Proc. EMC Europe2012, D8-1, Rome, September.

Hikage T., Kawamura Y., Nojima T., Koike B., Fujimoto H., Toyoshima T. [2011a], “Active implantable medical device EMI assessments for electromagnetic emitters operating at various RF bands,” Proc. IMWS-IWPT2011, pp. 109-112, Kyoto, Japan, May.

Hikage T., Kawamura Y., Nojima T., Koike B., Fujimoto H., Toyoshima T. [2011b], “An assessment methodology of active implantable medical device EMI based upon near field distribution analysis,” Proc. 2011 IEEE Int. Symp. AP-S and USNC/URSI National Radio Science Meeting, 131.5, Spokane, USA, July.

Hikage T., Irie Y., Nojima T. [2011c], "Numerical estimation of EMI impact by cellular radio on implantable cardiac pacemakers in elevator using various anatomical whole-body human models," Proc. 33rd Ann. Meet. BEMS, PA-107, Halifax, Canada, June.

Hikage T., Kawamura Y., Nojima T. [2011d], "Numerical Estimation Methodology for RFID/Active Implantable Medical Device-EMI based upon FDTD Analysis," Proc. XXX URSI-GA, K05.6, Istanbul, Turkey, August

Hikage T., Kawamura Y., Nojima T. [2012], "Numerical estimation on active implantable medical device EMI due to magnetic resonance wireless power transmission coils," Proc. 34th Ann. Meet. BEMS, pp. 87-89, Brisbane, Australia, June.

Hikage T., Kawamura Y., Nojima T., Cabot E. [2012], "Numerical assessment methodology for active implantable medical device EMI due to magnetic resonance wireless power transmission antenna," Proc. EMC Europe2012, D4-1, Rome, September.

Hikage T., Suzuki T., Nojima T. [2013], "Numerical assessment method for implantable cardiac pacemaker EMI triggered by 10 MHz-band wireless power transfer coils," Proc. Joint Workshop URSI-K and ICNIRP, p. 38, Paris, France, August.

Hikage T., Shirafune M., Nojima T., Fujimoto H., Toyoshima T. [2013], "*In vitro* assessment of EMI from RFID interrogator on implantable cardiac pacemakers and implantable cardioverter defibrillators," Proc. Int. Symp. Electromagnetic Theory, pp.1140-1143, Hiroshima, Japan, May.

Hikage T., Kwamura Y., Nojima T., Nagaoka T., Watanabe S. [2013], "Local SAR Evaluation of Anatomical Human Implanted with Metallic Osteosynthesis Plates Exposed to UHF Radio Waves," EMC Europe 2013, pp.165-168, Brugge, Belgium.

Hirai Y., Suzuki Y., Wada K., Wake K., Ushiyama A., Ohkubo C. [2011], "Development of the exposure apparatus with the localized magnetic field at 20 kHz for pregnant rats," 33rd Ann. Meet. BEMS, Halifax, Canada, June.

Hirata A., Masuda H., Kanai Y., Asai R., Fujiwara O., Arima T., Kawai H., Watanabe S., Lagroye I., Veyret B. [2011], "Computational modeling of temperature elevation and thermoregulatory response in the brains of anesthetized rats locally exposed at 1.5 GHz," Phys. Med., Biol., 56, pp.7639-7657.

Hirata A. Laakso I., Chan K.H., Fujiwara O., Nagaoka T., Watanabe S., Conil E., Wiart J. [2012], "Estimation of the whole-body averaged SAR of grounded human models for plane wave exposure at respective resonance frequencies," Phys. Med., Biol., 57, pp.8427-8442.

Iida K., Shimizu H., Shimizu K. [2013], "Theoretical analysis of body hair movement in ELF electric field exposure in different environmental conditions," Proc. 35th Int. Conf. IEEE EMBS, Osaka, Japan, July.

Ikehata M., Yoshie S., Hayakawa H. [2010], "Evaluation of biological effects of intermediate frequency magnetic field," 83rd Ann. Meet. Japan Soc. Occupational Health, Fukui, Japan, May. (Japanese)

Ikehata M., Wada K., Suzuki Y., Yoshie S., Sakai T., Wake K., Nakasono S., Taki M., Ohkubo C. [2010a], "Development of exposure system of intermediate frequency magnetic fields for *in vitro* test systems," 32th Ann. Meet. BEMS, Seoul, Korea, June.

Ikehata M., Wada K., Suzuki Y., Yoshie S., Sakai T., Wake K., Nakasono S., Taki M., Ohkubo C. [2010b], "Evaluation of genotoxic effects of intermediate frequency magnetic field in *in vitro* micronucleus assay using CHL/IU cells," AP-RASC'10, Toyama, Japan, September.

Ikehata M., Yoshie S., Ogasawara Y., Ishii K., Wada K., Suzuki Y., Sakai T., Wake K., Nakasono S., Taki M., Ohkubo C. [2010], "Evaluation of biological effects by exposure to intermediate frequency magnetic fields," 6th IWBEEF, Bodrum, Turkey, October.

Ikehata M. [2011], "Evaluation of biological effects of magnetic fields-from static to intermediate frequency-," ISAP2011, Jeju, Korea, October.

Ikehata M., Yoshie S., Hayakawa T., Suzuki Y., Taki M. [2011], "EMFs in railway system -evaluation of biological effects and current trends of its health risk assessment-," WCRR2011, Lille, France, May.

Ikehata M., Wada K., Suzuki Y., Yoshie S., Sakai T., Wake K., Nakasono S., Taki M., Ohkubo C. [2011], "Evaluation of genotoxic effects of intermediate frequency magnetic field in *in vitro* micronucleus assay using CHL/IU Cells," XXX URSI-GA, Istanbul, Turkey, August.

Ikehata M., Yoshie S., Wada K., Suzuki Y., Sakai T., Wake K., Nakasono S., Taki M., Ohkubo C. [2011], "Evaluation of biological effects of intermediate frequency magnetic field in *in vitro* micronucleus assay," 2nd Bioelectromagnetics Symp., Koganei, Japan, January.

Ikehata M. [2013], "EMF issue in railway systems- evaluation of biological effects and trends of regulation in Japan-," ISEF2013, Ohrid, Macedonia, September (*invited*).

Ikehata M., Yoshie S., Hayakawa T., Suzuki Y., Taki M. [2013], "EMF issue in railway systems- evaluation of biological effects and trends of regulation in Japan-," WCRR2013, Sydney, Australia, November.

Ishihara S., Iyama T., and Onishi T. [2011], "Method for evaluating EMI of implanted medical devices from body area network devices," Proc. APEMC2011, S-We2-3, Jeju, Korea, May.

Ishii N., Miyota Y., Hamada L., Watanabe S. [2011], "Effect of higher modes on waveguide aperture covered by a dielectric slab in the liquid," ISAP 2011, Jeju, Korea.

Ishii N., Miyota Y., Sato K., Hamada L., Watanabe S. [2012], "SAR-probe calibration system using reference dipole antenna in tissue-equivalent liquid," IEICE Trans. Commun., E95-B, pp.60-68.

Itakura H., Saito K., Takahashi M., Ito K. [2012], "Development of biliary stent compatible with microwave hyperthermia for bile duct carcinoma," Jpn. Soc. Thermal Med. 28, pp.43-51.

Ito A., Simba A.Y., Arima T., Hamada L., Watanabe S., Uno T. [2011], "A liquid-type human-body equivalent antenna with improved induced current distribution," ISAP 2011, Jeju, Korea.

Ito K., Saito K. [2011], "Development of microwave antennas for thermal therapy," Curr. Pharm. Design 17, pp. 2360-2366.

Kanai S, Taniguchi N, Okano H. [2011], "Effect of magnetotherapeutic device on pain associated with neck and shoulder stiffness," Altern. Ther. Health Med. 17, pp. 44-48.

Kanai Y, Hirata A, Fujiwara O, Masuda H, Kawai H, Arima T, Watanabe S. [2010], "Modeling of temperature rise in rats for intense localized microwave exposure at 1.5 GHz," IEICE Trans. Electron., J93-C, pp.638-646.

Kato T., Sekino M., Matsuzaki T., Nishikawa A., Saitoh Y., Ohsaki H. [2012], "Electromagnetic characteristics of eccentric figure-eight coils for transcranial magnetic stimulation: A numerical study," J. Appl. Phys. 111, 07B322.

Kawai Y., Hikage T., Nagaoka T., Watanabe S., Nojima T. [2011], "Whole-body averaged SAR estimation of Japanese humans exposed to 2 GHz H-polarized plane-wave using external electric-field scanning," AP-EMC, Jeju, Korea.

Kawai H., Wake K., Arima T., Watanabe S. [2011], "A head-local-exposure system for rats using a figure-8 loop antenna in the 2 GHz band," IEICE Trans. Commun., E94-B, pp.1757-1760.

Kawamura Y., Hikage T., Nojima T., Nagaoka T., Watanabe S. [2012], "Whole-body averaged SAR measurements of postured phantoms exposed to E-/H-polarized plane-wave using cylindrical field scanning," Proc. ISAP2012, pp.676-679, Nagoya, Japan.

Kawamura Y., Hikage T., Nojima T., Nagaoka T., Watanabe S. [2012], "Local SAR evaluation of anatomical human head model implanted with metal plates exposed to UHF radio waves," PPEMC, Tokyo, Japan.

Koike A., Suzuki Y., Kojima M., Sakai T., Wake K., Watanabe S., Taki M., Sasaki H., Sasaki K. [2011], "An investigation of the heat transport mechanism under the millimeter-wave exposure considering the convection in the anterior chamber of rabbit's eye," XXX URSI-GA, Istanbul, Turkey, August.

Kojima M., Sasaki H., Sasaki K., Sakai T., Wake K., Watanabe S., Kamimura Y., Hirata A., Suzuki Y., Taki M. [2011], "Investigation of acute ocular injury threshold by 76 GHz band exposure in rabbits," XXX URSI-GA, Istanbul, Turkey, August.

Kojima M., Naillia H., Suzuki Y., Sasaki K., Wake K., Watanabe S., Taki M., Kamimura Y., Hirata A., Sasaki K., Sasaki H. [2012], "Ocular temperature measurement during 40 GHz exposure to rabbit," The 2012 Korea-Japan Joint Conference (KJJC2012), Seoul, Korea.

Laakso I., Tsuchida S., Hirata A. [2012], "Evaluation of SAR in a human body model due to wireless power transmission in the 10 MHz band," Phys. Med. Biol., 57, pp. 4991–5002.

Laakso I., Hirata A. [2013], "Evaluation of the induced electric field and compliance procedure for a wireless power transfer system in an electrical vehicle," Phys. Med. Biol., 58, pp. 7583–7593.

Le D.T., Iyama T., Hamada L., Watanabe S., Onishi T. [2012], "Electric field measurements for MIMO wireless communication transmitters in electromagnetic exposure evaluation," Proc. PPEMC, pp.1-4, Tokyo, Japan.

Masuda H., Hirata A., Kawai H., Wake K., Watanabe S., Arima T., de Gannes F. P., Lagroye I., Veyret B. [2011], "Local exposure of the rat cortex to radiofrequency electromagnetic fields increases local cerebral blood flow along with temperature," Journal of Applied Physiology Articles, 110, pp.142-148.

Miyakoshi J. [2013], "Cellular and molecular responses to Radio-Frequency electromagnetic fields," Proc. IEEE, 101, pp. 1494 – 1502.

Mizuno M., Saito S., Fukunaga K., Hosako I. [2011], "Absorption properties of oriented collagen in Terahertz band," IEMMW-THz2011, Houston, USA, October.

Nagaoka T., Watanabe S. [2011a], "Variability in whole-body averaged SAR for young children exposed to vertically and horizontally polarized electromagnetic plane waves from 30 MHz to 3 GHz," AP-EMC, Jeju, Korea.

Nagaoka T., Watanabe S. [2011b], "Japanese voxel-based computational models and their applications for electromagnetic dosimetry," XXX URSI-GA, Istanbul, Turkey, August.

Nagaoka T., Watanabe S. [2011c], "Multi-GPU Accelerated three-dimensional FDTD method for electromagnetic simulation," Proc. 33rd Ann. Int. Conf. IEEE EMBS, pp.401-404, Boston, USA, August.

Nagaoka T., Watanabe S. [2011d], "GPU-based 3D-FDTD computation for electromagnetic field dosimetry," 10th IEEE Region8 AFRICON 2011 Conf., Livingstone, Zambia, September.

Nagaoka T., Watanabe S. [2011e], "Personalized computational models in human anatomy for electromagnetic dosimetry," ISABEL2011, Barcelona, Spain.

Nagaoka T., Niwa T., Watanabe S. [2012], "High-fidelity modeling of human fetuses in the second and third trimesters of pregnancy," 7th IWSBEEMF, Valletta, Malta, October.

Nagaoka T., Watanabe S. [2012a], "Shape deformable human models for electromagnetic dosimetry," KJJC2012, Seoul, Korea.

Nagaoka T., Watanabe S. [2012b], "Accelerating three-dimensional FDTD calculations on GPU clusters for electromagnetic field simulation," Proc. 34th Int. Conf. IEEE EMBS, pp.5691-5694, San Diego, USA.

Nagaoka T., Watanabe S. [2012c], "A Study of SAR estimation by shape deformable human models in anatomy," EMC Europe 2012, Rome, Italy.

Nagaoka T., Niwa T., Watanabe S. [2013a], "Computational modeling of human fetuses for electromagnetic dosimetry," Proc. EuCAP 2013, pp.1972-1973, Gothenburg, Sweden.

Nagaoka T., Niwa T., Watanabe S. [2013b], "Specific absorption rate in mothers and fetuses in the second and third trimesters of pregnancy," Proc. ISMOT-2013, pp.82-85, Kuala Lumpur, Malaysia.

Nagaoka T., Watanabe S. [2013], "Large-scale calculation of the specific absorption rate in a human body exposed to RF-EMFs by GPU cluster system," EMC Europe 2013, pp.891-895, Brugge, Belgium.

Nagase K., Ishihara S., Higashiyama J., Onishi T., Tarusawa Y. [2012], "Electromagnetic interference with medical devices from mobile phones using high-speed radio access technologies," IEICE Commun. Express 1(6), pp. 222-227.

Naillia H., Kojima M., Suzuki Y., Sasaki K., Sasaki H., Sasaki K., Wake K., Watanabe S., Taki M., Kamimura Y., Hirata A. [2012], "Investigation of ocular temperature change during 40 GHz band exposure on rabbit," EMC Europe 2012, Rome, Italy.

Nakajima H., Takahashi M., Saito K., Ito K. [2013a], "Simple urination detection system using RFID," IEICE Commun. Express 2, pp. 98-103.

Nakajima H., Takahashi M., Saito K., Ito K. [2013b], "Development of RFID antenna for detection of urination," IEICE Trans. Commun. E96-B, pp. 2244-2250.

Nakasono S., Ikehata M., Negishi T. [2010], "Intermediate frequency magnetic fields did not have genotoxic and promotion potentials in *in vitro* tests," 6th IWBEEF, Bodrum, Turkey, October.

Nakasono S., Ikehata M., Takahashi M., Negishi T. [2011], "Effect of intermediate frequency magnetic fields on chromosome aberrations or co-genotoxic potentials by *in vitro* chromosome aberration tests using human lymphoblast cell line," TK6, CRIEPI Report, V11065.

Nakasono S., Ikehata M., Takahashi M., Yoshie S., Negishi T. [2011], "Intermediate frequency magnetic fields did not have promotion or co-promotion potentials in transformation assay using Bhas42 cells," 33rd Ann. Meet. BEMS, Halifax, Canada, June.

Nakasono S., Ikehata M., Takahashi M., Yoshie S., Negishi T. [2013], "Intermediate frequency magnetic fields did not have genotoxic or promotion potentials in *in vitro* assay," CIGRE 2013 EMF-ELF Colloquium, Nara, Japan, October.

Nakatani-Enomoto S., Furubayashi T., Ushiyama A., Groiss S.J., Ueshima K., Sokejima S., Simba A.Y., Wake K., Watanabe S., Nishikawa M., Miyawaki K., Taki M., Ugawa Y. [2013], "Effects of electromagnetic fields emitted from W-CDMA-like mobile phones on sleep in humans," Bieoelectromagnetics, 34, pp. 589–598.

Negishi T., Nishimura I., Nakasono S., Takahashi M., Mitani T. [2011], "Evaluation of biological effects of intermediate frequency magnetic field," CRIEPI Report, V04.

Nishimura I., Mitani T., Negishi T. [2010], "- Effects of 60 kHz magnetic field exposure on the rat fertility and early embryonic development to implantation -," CRIEPI Report, V10006.

Nishimura I., Negishi T. [2011], "Biological effects of intermediate frequency magnetic field exposure -, Chick embryotoxicity by exposure to 20 kHz or 60 kHz magnetic field for 19 days during embryogenesis -," CRIEPI Report, V11005.

Nishimura I., Mitani T., Negishi T. [2012a], "Evaluation of biological effects of intermediate frequency magnetic field - Subchronic toxicity study of 60 kHz magnetic field in the rats -," CRIEPI Report, V12001.

Nishimura I., Mitani T., Negishi T. [2012b], "Changes in blood hematology and clinical chemistry of pregnant rats exposed to intermediate frequency magnetic fields," 7th IWSBEEMF, Valletta, Malta, October.

Nishimura I., Oshima A., Shibuya K., Mitani T., Negishi T. [2012], "Absence of reproductive and developmental toxicity in rats following exposure to a 20-kHz or 60-kHz magnetic field," Regul. Toxicol. Pharm. 64, pp. 394-401.

Nishimura I., Tanaka K., Negishi T. [2013a], "Intermediate frequency magnetic field and chick embryotoxicity," Congenital Anomalies 53, pp. 115-121.

Nishimura I., Mitani T., Negishi T. [2013b], "Evaluation of biological effects of intermediate frequency magnetic field - Subchronic toxicity study of 20 kHz magnetic field in the rats -," CRIEPI Report, V13010.

Nishimura I., Mitani T., Negishi T. [2013c], "Intermediate frequency magnetic field exposure does not affect reproductive and developmental functions in the rat," CIGRE 2013 EMF-ELF Colloquium, Nara, Japan, October.

Nishimura T., Tada H., Guo X., Murayama T., Teramukai S., Okano H., Yamada J., Mohri K., Fukushima M. [2011], "A 1-μT extremely low-frequency electromagnetic field vs. sham control for mild-to-moderate hypertension: a double-blind, randomized study," Hypertens. Res. 34, pp. 372-377.

Ogasawara Y., Ikehata M., Sakaguchi R., Awano S., Yoshie S., Ohkubo C., Ishii K. [2011], "Effects of exposure to intermediate frequency magnetic fields on gene expression of estrogen-regulated gene in MCF-7 cells," XXX URSI-GA, Istanbul, Turkey, August.

Ogasawara Y., Sakaguchi R., Awakura S., Ishii K., Ikehata M., Yoshie S., Ohkubo C. [2011], "Evaluation of biological effects by estrogen reporter gene assay," MAG-11-080, Technical Meeting of Magnetics in Fundamentals and Materials Society of IEEJ, Abiko, Japan, November.

Ogasawara Y., Ikehata M., Yoshie S., Nakasono S., Ohkubo C., Ishii K. [2012], "Effects of exposure to 21 kHz magnetic fields on estrogen-regulated gene expression in MCF-7 cell," 34th Ann. Meet. BEMS, Brisbane, Australia, June.

Ohtani S, Ushiyama A, Maeda M, Ogasawara Y, Kunugita N, Wang J, Ishii K. [2012], "*In vivo* immunotoxic assessment for radio frequency electromagnetic field with juvenile rat," 34th Ann. Meet. BEMS, Brisbane, Australia, June.

Oizumi T., Laakso I., Hirata A., Fujiwara O., Watanabe S., Taki M., Kojima M., Sasaki H., Sasaki K. [2012], "Analysis of temperature elevation in the lens of human and rabbit models for localized microwave exposure at 2.45 GHz," IEICE Trans. Commun., J95-B, pp.381-384.

Oizumi T., Laakso I., Hirata A., Fujiwara O., Watanabe S., Taki M., Kojima M., Sasaki H., Sasaki K. [2013], "FDTD analysis of temperature elevation in the lens of human and rabbit models due to near-field and far-field exposures at 2.45 GHz," Radiat. Prot. Dosim. 155, pp.284-291.

Okano H, Ino H, Osawa Y, Osuga T, Tatsuoka H. [2011], "The effects of static magnetic fields on neurotransduction," 33rd Ann. Meet. BEMS, Halifax, Canada, June.

Okano H, Ino H, Osawa Y, Osuga T, Tatsuoka H. [2012], "The effects of moderate-intensity gradient static magnetic fields on nerve conduction," Bioelectromagnetics 33, pp. 518-526

Okano H, Kitahata H. [2013], "Modulation of the shape and speed of a chemical wave in an unstirred Belousov-Zhabotinsky reaction by a rotating magnet," Bioelectromagnetics 34, pp. 220-230.

Okano H, Ansei Y, Hattori Y, Osuga T, Tatsuoka H. [2013], "The effects of moderate-intensity gradient static magnetic fields on neuromuscular junction," BioEM2013, Thessaloniki, Greece, June.

Onishi T, Iyama T, Hamada L, Watanabe S, Hirata A. [2010], "Evaluation of SAR and temperature elevation using Japanese anatomical human models for body-worn device," IEICE Trans. Commun., E93-B, pp. 3643-3646.

Onishi T. Nagaoka T., Iyama T., Hamada L., Watanabe S., Hirata A. [2012], "Exposure evaluation with respect to wireless data transmission terminals used close to the body," KJJC2012, Seoul, Korea.

Park S.W., Wake K., Watanabe S. [2012a], "Dosimetry for a wireless power transfer system using resonance, and investigation of electric coupling to a human body," KJJC2012, Seoul, Korea.

Park S.W., Wake K., Watanabe S. [2012b], "Investigation of numerical methods and dosimetry for a wireless power transfer system using electromagnetic resonance," EMC Europe 2012, Rome, Italy.

Park S.W., Wake K., Watanabe S. [2013a], "Calculation errors of the electric field induced in a human body under quasi-static approximation conditions," IEEE Trans. Microwave Theory and Tech., 61, pp.2153-2160.

Park S.W., Wake K., Watanabe S. [2013b], "Incident electric field effect and numerical dosimetry for a wireless power transfer system using magnetically coupled resonances," IEEE Trans. Microwave Theory and Tech., 61, pp.3461-3469.

Pei C., Zhu H., Demachi K., Sekino M., Uesaka M. [2012], "Magnetic field gradient imaging for material classification by magnetic resonance imaging," Int. J. Appli. Electrom. 39, pp. 335-340.

Saito A, Saito A, Goto M, Shimba K, Moriguchi H, Kotani K, Jimbo Y. [2011], "Soft magnetic material based localized magnetic stimulation to cultured neuronal cells and modulation of network activities," 33rd Ann. Int. Conf. IEEE EMBS, Boston, USA, August.

Saito K., Kawamura T., Takahashi M., Ito K. [2010], "Proposition of improve birdcage coil for MRI system with no lumped circuit elements," IEICE Trans. Commun. J93-B, pp.1644-1650.

Saito K., Watanabe R., Endo Y., Watanabe S., Takahashi M., Ito K. [2011a], "Evaluations on SAR around Implanted Cardiac Pacemaker by Mobile Radio Terminal," EuCAP, pp.2931-2933, Rome, Italy.

Saito K., Watanabe S., Endo Y., Takahashi M., Ito K. [2011b], "Calculations of SAR around Implanted Cardiac Pacemaker Induced by Wireless Radio Terminal," 10th IEEE Region8 AFRICON 2011 Conf., Livingstone, Zambia, September.

Saito K., Endo Y., Watanabe S., Takahashi M., Ito K. [2012], "SAR evaluations around implanted cardiac pacemaker caused by mobile radio terminal," 7th IWSBEEMF, Valletta, Malta, October.

Saito K., Takahashi M., Ito K. [2013], "Generation of controllable heating patterns for interstitial microwave hyperthermia by coaxial-dipole antennas," IEICE Trans. Commun. E96-C, pp.1178-1183.

Sakai T., Wake K., Watanabe S., Hashimoto O. [2010], "Temperature compensation of complex permittivities of biological tissues and organs in quasi-millimeter-wave and millimeter-wave bands," J. Korean Inst. Electromagnetic Eng. Sci. 10, pp.231-236.

Sakurai T., Kiyokawa T., Narita E., Suzuki Y., Taki M., Miyiakoshi J. [2011] "Analysis of gene expression in a human-derived glial cell line exposed to 2.45 GHz continuous radiofrequency electromagnetic fields," J. Radiat. Res., 52, pp.185-192.

Sasaki K., Segawa H., Mizuno M., Wake K., Watanabe S., Hashimoto O. [2013], "Development of the complex permittivity measurement system for high-loss biological samples using the free space method in quasi-millimeter and millimeter wave bands," Phys. Med. Biol., 58, pp.1625-1633.

Sasaki K., Wake K., Watanabe S. [2013], "A dosimetric study using best-fit Cole-Cole parameters of biological tissues and organs in radio frequency band," Proc. Int. Symp. Electromagnetic Theory, pp. 630-633, Hiroshima, Japan, May.

Sato A., K. Fujii, Wake K., Watanabe S., Matsumoto Y., Hashimoto O. [2013], "Improvement of Spatial Resolution of a Magnetic Field Measurement System for Intermediate Frequency Range," IEICE Trans. Electron., J96-C, pp.245-251.

Schüz J., Grell K., Kinsey S., Linet MS, Link MP, Mezei G., Pollock BH, Roman E., Zhang Y., McBride ML, Johansen C., Spix C., Hagihara J., Saito AM, Simpson J., Robison LL, Dockerty JD, Feychting M., Kheifets L., Frederiksen K. [2012], "Extremely low-frequency magnetic fields and survival from childhood acute lymphoblastic leukemia: an international follow-up study," Blood Cancer J. 21(2), e98.

Sekino M., Yasuda H., Miyazoe A. and Ohsaki H. [2011], "Concentric slitting of a ring-shaped bulk superconductor for a reduction in circumferential inhomogeneity of the trapped magnetic field," IEEE Trans. Appl. Supercon. 21, pp. 1588-1591.

Sekino M., Miyazoe A., Ohsaki H., Hisatsune T., Ozaki O., Kiyoshi T., Wada H. [2011], "MRI using a superconducting magnet with an off-centered homogeneous field zone," J. Appl. Phys. 109, 07D335.

Shiina T., Suzuki Y., Wake K., Taki M. [2012], "Evaluation of polarization characteristics of millimeter-wave *in vitro* exposure apparatus based on disc-shaped post-wall waveguide," Proc. PPEMC, pp.17-20, Tokyo, Japan.

Shimizu H. O., Iida K., Shimizu K. [2013], “Theoretical analysis of body hair movement in ELF electric field,” CIGRE 2013 EMF-ELF Colloquium, Nara, Japan, October.

Shiraishi T., Wake K., Watanabe S., Arima T., Uno T. [2011], “A development of a multiband antenna for local exposure of a rat head,” ISAP 2011, Jeju, Korea.

Simba A. Y., Ito A., Hamada L., Watanabe S., Arima T., Uno T. [2011], “Comparison of induced ankle currents of the human-body equivalent antennas and anatomically human models exposed to nearby monopole antennas,” XXX URSI-GA, Istanbul, Turkey, August.

Simba A. Y., Wake K., Watanabe S., Nakatani-Enomoto S., Ugawa Y. [2011], “Exposure system for a study of effects of mobile phones to human sleep and its dosimetry evaluation using numerical mobile phone,” 10th IEEE Region8 AFRICON 2011 Conf., Livingstone, Zambia, September.

Simba A. Y., Watanabe S., Hikage T., Nojima T. [2011], “Experimental and numerical investigation of the maximum specific absorption rate in a spherical phantom when operating a mobile phone near a metallic wall,” IET Science, Measurement and Technology, 5, pp.225-230.

Simba A. Y., Ito A., Hamada L., Watanabe S., Arima T., Uno T. [2012], “Development of liquid-type human-body equivalent antennas for induced ankle current measurements at VHF band,” IEEE Trans. Electromagn. C. 54, pp.563-573.

Suzuki Y., Koike A., Kojima M., Sasaki K., Wake K., Taki M., Watanabe S., Naillia H., Sasaki K., Sasaki H. [2012], “Computational and experimental dosimetry for rabbit eyes exposed to millimeter waves,” KJJC2012, Seoul, Korea.

Takahashi M., Nakata S., Saito K., Ito K. [2010], “Characteristics of antenna on cardiac pacemaker embedded in multilayered models,” IEICE Trans. Commun. J93-B, pp.1636-1643.

Takahashi M, Tsujimura N, Otsuka K, Yoshino T, Mori T, Matsunaga T, Nakasono S. [2012], “Comprehensive evaluation of leukocyte lineage derived from human hematopoietic cells in humanized mice,” J. Biosci. Bioeng. 113(4), pp. 529-35.

Takahashi M., Tsujimura N., Yoshino T., Hosokawa M., Otsuka K., Matsunaga T, Nakasono S. [2012] “Assessment of benzene-induced hematotoxicity using a human-like hematopoietic lineage in NOD/Shi-scid/IL-2Rγ^{null} mice,” PLoS ONE 7(12), e50448.

Taki M., Wake K. [2012], “Exposure assessment and dosimetry for epidemiology on the mobile phone use,” Proc. 2012 Asia-Pacific Symp. EMC, pp.737-740, Singapore, May.

Tanaka K., Tateno A., Saito K., Nagaoka T., Takahashi M., Ito K. [2012], “Construction of a realistic calculation model of a flip phone for SAR evaluations,” Proc.ISAP2012, pp.684-687, Nagoya, Japan.

Tarao H., Hayashi N., Matsumoto M., Isaka K. [2010], “Numerical analysis of internal human body resistance at power frequency,” Proc. ACED2010, A-15, Xi'an, China, November.

Tarao H., Hayashi N., Korpinen L., Matsumoto T., Isaka K. [2011a], “Internal body resistance of various human models at power frequency,” Proc. 32th Ann. Meet. BEMS, PA-37, Seoul, Korea, June.

Tarao H., Hayashi N., Korpinen L., Matsumoto T., Isaka K. [2011b], “Calculation of induced electric fields in human models exposed to ELF magnetic and electric fields,” Proc. ISH2011, No.A-005, Hannover, Germany, August.

Tarao H., Hayashi N., Matsumoto T., Isaka K. [2012a], “Currents and electric fields induced in anatomically-realistic human models by ELF electric fields,” Proc. ACED2012, A-024, Johor, Malaysia, December.

Tarao H., Hayashi N., Korpinen L., Gonzalez J., Matsumoto T., Isaka K. [2012b], “Effect of tissue conductivity on internal body resistances of numerical human model at power frequency,” Proc. 34th Ann. Meet. BEMS, PB-34, Brisbane, Australia, June.

Tarao H., Kuisti H., Korpinen L., Hayashi N., Isaka K. [2012c], “Effects of tissue conductivity and electrode area on internal electric fields in a numerical human model for ELF contact current exposures,” Phys. Med. Biol. 57(10), pp.2981-2996.
Tarao H., Hayahsi N., Koripinen L., Matsumoto T., Isaka K. [2013a], “Calculation of contact currents in a human body in contact with a car in 60 Hz electric fields,” BioEM 2013, PA-25, Thessaloniki, Greece, June.

Tarao H., Hayashi N., Korpinen L., Matsumoto T., Isaka K. [2013b], “Numerical estimations of induced and contact currents in human body in contact with a car in 60 Hz electric fields,” Proc. ISH2013, PA-27, pp.193-195, Seoul, Korea, August.

Tarao H., Hayashi N., Matsumoto T., Isaka K. [2013c], “Currents and electric fields induced in anatomically realistic human models by extremely low frequency electric fields,” J. Energy Power Eng.7(10), pp.1985-1991.

Tarao H., Korpinen L., Kuisti H., Hayashi N., Elovaara J., Isaka K. [2013d], “Numerical evaluation of currents induced in a worker by ELF non-uniform electric fields in high voltage substations and comparison of them with experimental results,” Bioelectromagnetics 34(1), pp.61-73.

Toyoshima H., Ishii N., Hamada L, Watanabe S. [2012], “Near-field gain measurement of waterproofed shielded loop antenna in tissue-equivalent liquid,” Proc. ISAP2012, pp.1087-1090, Nagoya, Japan.

Tsubouchi K., Saito K., Takahashi M., Ito K., Tsuyuguchi T., Yamaguchi T., Kato K. [2010], “Experimental evaluation of microwave antenna for thermal treatment of bile duct carcinoma,” Thermal Med., 26, pp. 121-130.

Ueno S., Okano H. [2011], “Static, low frequency and pulsed magnetic fields in biological systems,” In: “Electromagnetic Fields in Biological Systems,” James C. Lin eds. Boca Raton: CRC Press. 115–196.

Ushiyama A. Unno A., Ohtani S., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2011a], “The effects of 21 kHz intermediate frequency magnetic fields on blood properties and immune systems in rats.” 33rd Ann. Meet. BEMS, Halifax, Canada, June.

Ushiyama A., Unno A., Ohtani S., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2011b], “Short-term whole body exposure of intermediate frequency magnetic fields to rats does not affect blood properties and immune systems,” XXX URSI-GA, Istanbul, Turkey, August.

Ushiyama A., Ohtani S., Maeda M., Hirai Y., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2012], “Effects of abdominal local exposure of intermediate frequency (21kHz) magnetic fields on fetal development in rats,” 34th Ann. Meet. BEMS, Brisbane, Australia, June.

Ushiyama A., Ohtani S., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2012], “The effects of 21 kHz intermediate frequency magnetic fields on blood properties and immune systems in juvenile rats,” Korea-Japan EMT/EMC/BE Joint Conference (KJJC-2012), Seoul, Korea, May.

Ushiyama A., Ohtani S., Maeda M., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2013a], “Lack of teratological effects in pregnant rats being locally exposed to their abdomen of intermediate frequency magnetic fields,” BioEM2013, Thessaloniki, Greece, June.

Ushiyama A., Ohtani S., Maeda M., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2013b], “Teratological study in pregnant rats being locally exposed to their abdomen of Intermediate frequency (21kHz) magnetic fields,” Joint Workshop of URSI Commission K and ICNIRP, Paris, France, August.

Ushiyama A., Ohtani S., Maeda M., Suzuki Y., Wada K., Kunugita N., Ohkubo C. [2013c], “The 21 kHz intermediate frequency magnetic fields do not affect on blood properties and immune systems in juvenile rats,” CIGRE 2013 EMF-ELF Colloquium, Nara, Japan, October.

Wada K., Suzuki Y., Ushiyama A. [2011], “Experimental verification of a localized magnetic field generator Using a Two-Layered Coil,” 33rd Ann. Meet. BEMS, Halifax, Canada, June.

Wakatsuchi H., Sakai T., Watanabe S., Kojima M., Yamashiro Y., Sasaki K., Sasaki H., Hashimoto O. [2012], “Application of reproducible measurements of complex permittivities to crystalline lens from 500 MHz to 50 GHz,” IEEE Trans. Electromgn. C., 54, pp.1298-1301.

Wake K., Arima T., Watanabe S., Masao T. [2011], “SAR Distrubutions in a child head phantom in the vicinity of recent mobile phones,” XXX URSI-GA, Istanbul, Turkey, August.

Wang J., Wake K., Watanabe S., Fujiwara O. [2011], “Statistical dosimetry analysis in whole-body exposure setup based on rat’s activity behavior,” XXX URSI-GA, Istanbul, Turkey, August.

Wang J., Wake K., Kawai H., Watanabe S., Fujiwara O. [2012], “Statistical determination of whole-body average SARs in a 2 GHz whole-body exposure system for unrestrained pregnant and newborn rats,” Phys. Med., Biol., 57, pp.143-154.

Wang J., Kawai H., Wake K., Watanabe S., Fujiwara O. [2013], “Performance and Validation of a Broadband-Multigeneration Exposure System for Unconstrained Rats,” IEEE Trans. Microwave Theory and Tech., 61, pp.326-334.

Wiart J., Watanabe S., Bloch I., Anquez J., de la Plata Alcalde J. P., Angelini E., Boubekeur T., Faraj N., Person C., Pinto Y., Varsier N., Kientega T., Jala M., Hadjem A., Wong M.F., Conil E., Sudret B., Nagaoka T., Wake K., Fujiwara O., Hirata A., Wang J., Saito K., Takahashi M., Ito K. [2011], “Fetus RF exposure analysis. Preliminary results based on three realistic 3D digital models,” XXX URSI-GA, Istanbul, Turkey, August.

Win Shwe T., Ohtani S., Ushiyama A., Fujimaki H., Nitta H., Kunugita N. [2012], “Effect of exposure to intermediate frequency magnetic fields on memory function-related gene expression in hippocampus of C57BL mice,” Neuroscience 2012, New Orleans, US, October.

Win-Shwe TT, Ohtani S., Ushiyama A., Fujimaki H., Kunugita N. [2013], “Can intermediate-frequency magnetic fields affect memory function-related gene expressions in hippocampus of C57BL/6J mice?,” J. Toxicol. Sci. 38 (2), pp. 169-176.

Xu S., Okano H., Tomita N., Ikada Y. [2011], “Recovery effects of a 180 mT static magnetic field on bone mineral density of osteoporotic lumbar vertebrae in ovariectomized rats,” Evid Based Complement Alternat Med. 2011:620984.

Xu S., Okano H., Nakajima M., Hatano N., Iwata H., Tomita N., Ikada Y. [2012], “Static magnetic field effects on impaired peripheral vasomotion in conscious rats,” 7th IWSBEEMF, Valletta, Malta, October.

Xu S., Okano H., Nakajima M., Hatano N., Tomita N., Ikada Y. [2013], “Static magnetic field effects on impaired peripheral vasomotion in conscious rats,” Evid Based Complement Alternat Med. 2013:746968.

Yamaguchi-Sekino S., Ciobanu L., Sekino M., Djemai B., Geffroy F., Meriaux S., Okuno T., Le Bihan D. [2012], “Acute exposure to ultra-high magnetic field (17.2T) does not open the blood brain barrier,” Biol. Biomed. Reports 2, pp. 295-300.

Yamanaka Y., Wang J., Fujiwara O., Uda T. [2012], “Measurement of leaked high-frequency burst electric field and EMI evaluation for cardiac pacemaker in fusion facility,” IEEJ Trans. FM 132(5), pp.356-361.

Yanase K., Hirata A., Fujiwara O., Nagaoka T., Watanabe S. [2011], “Estimation of whole-body average SAR in grounded human models for RF far-field exposure,” IEICE Trans. Commun., J94-B, pp.226-233.

Yonebayashi J., Takamatsu S., Saito K., Takahashi M., Ito K. [2011], “Development of dynamic phantom for evaluation of Doppler radar for breath detection,” IEICE Trans. Commun. J94-B, pp.297-299.

Yoshie S., Ikehata M., Suzuki Y., Wada K., Okubo C., Hayakawa T. [2010], “Evaluation of biological effects of intermediate frequency magnetic field based on growth of DNA repair deficient mammalian cells and mutation assay,” AP-RASC’10, Toyama, Japan, September.

Yoshie S., Ikehata M., Suzuki Y., Wada K., Wake K., Sakai T., Nakasono S., Taki M., Ohkubo C. [2010], “Evaluation of mutagenicity and cytotoxicity of intermediate frequency magnetic field using DNA repair deficient mammalian cells,” 39th Ann. Meet. Jpn. Environmental Mutagen Soc., Tsukuba, Japan, November.

Yoshie S., Ikehata M., Suzuki Y., Wada K., Wake K., Sakai T., Nakasono S., Taki M., Ohkubo C. [2011], “The effect of intermediate frequency magnetic field on growth and mutagenesis in mammalian cells,” 84th Ann. Meet. Jpn. Soc. Occupational Health, Tokyo, Japan, March.

Yoshie S., Suzuki Y., Wada K., Wake K., Sakai T., Nakasono S., Taki M., Ohkubo C., Ikehata M. [2011], “Estimation of mutagenic rffects of intermediate frequency magnetic field using mammalian cells,” XXX URSI-GA, Istanbul, Turkey, August.

Yoshie S., Ikehata M., Ogasawara Y., Ishii K., Ohkubo C. [2012], “Evaluation of effect of intermediate frequency magnetic field on cell differentiation,” 55th Ann. Meet. Jpn. Radiation Research Soc., Sendai, Japan, September.

Yoshie S., Ikehata M., Ogasawara Y., Ishii K., Suzuki Y., Wada K., Wake K., Nakasono S., Taki M., Ohkubo C. [2013], “Evaluation of health effect of intermediate frequency magnetic field,” WCRR2013, Sydney, Australia, November.

Zhu H., Demachi K., Sekino M. [2011], “Phase gradient imaging for positive contrast generation to superparamagnetic iron oxide nanoparticle-labeled targets in magnetic resonance imaging,” Magn. Reson. Imaging 29, pp. 891-898.

Zhu H., Demachi K., Pei C., Sekino M., Uesaka M. [2012], “Correction of chemical shift misregistration by images from two different bandwidths,” Magn. Reson. Imaging 30, pp. 583-588.