

International Sym

„Electromagnetic Aspects of

CONFERENCE REPORT

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At this year's Prague symposium „Electromagnetic Aspects of Selforganization in Biology“ up to 50 scientists came together in order to discuss the following topics on three subsequent days: „Endogenous electromagnetic fields (EMF) in biological systems“, „Biophysical mechanisms of interaction between exogenous EMF and biological matter“ and „Medical application of emerging technologies“. The lecturers mostly presented still unpublished results of their experimental and theoretical research. Because of the subdivision in three thematic parts lecturers could report different aspects of their research, but this division also led to repetitions and certain lengths.



On the first day with the topic „Endogenous electromagnetic fields in biological systems“ the event focused on presenting measurements of electromagnetic signals of cells and on theoretical models concerning the role of EMF in the selforganization of biological systems.

R. Hölzel of the Fraunhofer Institut Biomedical Technologies in Berlin in this respect presented results of indirect and direct measurements of HF-signals in algae and yeast cells. The indirect measurements based upon the observation that cells attract strongly polarising particles such as barium titanate which concentrate in the immediate vicinity of the observed cell.

posium

Selforganization in Biology“



This effect called „microdielectrophoresis“ has its reason in the existence of strong non-homogeneous electric fields surrounding the cells. Through direct measurements with microelectrodes and sophisticated electronics cell signals from a minimal power of 10 up to 17 watt were recorded. In three different cell types, for example bakery yeast cells, signals in a frequency range from 1.5 to 52 MHz were found. J. Pokorny from the Institute for Radio Technologies and Engineering Techniques of the Akademie der Wissenschaften in Prag presented similar results. In mutated cells of bakery yeast his working group recorded signals in the range of 8 to 9

MHz. During measurements the observed cells all were in the phase of cell division (mitosis). In certain phases of mitosis the spindle apparatus necessary for the division of chromosomes is particularly strong. Since the occurrence of the cells' electromagnetic signals correlated with an increased development and activity of the spindle apparatus, a connection between these two cellular events is assumed. But the biological meaning of these signals is still not clear.

The presented theoretical model calculations on the role of EMF at the selforganization in biological systems referred to a broad range of topics from the modelling of a molecular motor and the calculation of possible breaks in the hydrogen bridge bond within the gene transporting molecules (DNS) caused by electric fields up to calculations of resonance frequencies of the spindle apparatus consisting of microtubuli (x-ray/infrared range).

Further, there were quite a few philosophically inspired papers. So V.L. Vvedensky from the Kurchatov Institute in Moskow suggested a „Reset-Command“ which should transport the cell from a „disorder“ (like in the case of a disease) to „normal behaviour“. Here, he compared cellular processes to computer processes and in this respect speculated on a corresponding impact of different medicines and medical applications (laser therapy, electromagnetic stimulation).

The second day focused on possible influences of externally effective (exoge-

nous) EMF. Studies on a wide spectrum of subjects, from humans, insects, bacteria up to molecular structures, were presented and hypotheses on the cause of the observed effects were discussed. L. von Klitzing from the Medical University of Lübeck for example presented studies on the impact of electromagnetic radiation on blood circulation in skin. Healthy subjects were exposed two times for ten minutes to mobile phones (936 MHz, 217 Hz modulated) and cordless phones (DECT 1.8 GHz, 100 Hz modulated). At the same time the blood circulation in skin was measured. The blood of some of the subjects periodically oscillated during exposure, contrary to the control group (without exposure) (frequency around 0.15 Hz). The results were interpreted as an effect on the autonomic nervous system, dependent on individual sensitivity. A possible impact of mobile phones (900 MHz, 217 Hz modulated) on biological systems has been examined by the working group around R. Jech from the research department neurology of the Karls University Prag. EEGs of narcolepsia patients were made (patients who by day suffer from several minutes long sleep seizures). Compared to healthy persons narcolepsia patients exposed to mobile phones showed no special characteristics in sleep and waking EEG. However, reaction tests showed significant changes of the visual potential in the right brain hemisphere (the mobile phone was placed to the right of the head). There was also a lengthening of reaction time of the patients

around 20 ms. Similar experiments with healthy subjects will follow.

Another focus of the day's topic was the impact of extremely low frequency electromagnetic fields (ELF-EMF). H.O. Gutzeit from the Institute for Zoology at the Technical University of Dresden presented a hypothesis surmising that ELF-EMF are so-called co-stressors. In an organism influenced by one or several sources (f.e. heat) therefore a 50 Hz/100 μ T magnetic field is sufficient to unbalance the organism. Respective studies carried out on nematodes and drosophila flies confirm his hypothesis. He was able to demonstrate that ELF-EMF contribute to certain stress factors in nematodes (increase of expression in a certain gene controlled by a so-called stress promoter). In drosophila flies an influence (slowing) on the embryonic development was indicated. The condition under which these effects occurred, however, was a strong heating of the organisms up to the barely sustainable physiological level. M. Vácha from the Research Department for Animal Physiology at the Masaryk University of Brno (Czech Republic) also examined the impact of low frequency EMF (50 Hz) on insects. He observed the growth of the pupa of the meal bug at an exposure between 0.05 and 1 mT. An alteration of growth could not be shown. Further studies addressed the impact of ELF-EMF on cells of the human immune system (lymphocytes). The Italian research group around M. Milani from the University of Milan observed a change of the CO₂ production, a decreased cell growth as well as various morphological cell changes in lymphocytes at an exposure of 50 Hz (magnetic field, pulsed). A. Jandova and collaborators explored the influence of an exposure at 50 Hz, 1 or 10mT, on the adherence properties of T-lymphocytes in

cancer patients and/or healthy study subjects. The adherence of these cells plays an important part regarding the mechanisms of specific immune responses and in healthy study subjects is stronger than in cancer patients. The indication of adherence intensity is used for example in immune tests to control the efficiency of lymphocytes. A. Jandova could prove an impact of low frequency EMF on the adherence ability of T-lymphocytes. Interestingly, she observed in the process that lymphocytes of cancer patients response with an increase of adherence, whereas the adherence of lymphocytes of healthy study subjects exposed to EMF significantly decreases.

Non-thermal effects of high frequency radiation (millisecond waves) have been explored by I.Y. Belyaev from the Department of Molecular Genetics at the University Stockholm in E coli cells. Following a detailed introduction into the applied method for viscosity measurement of lysed cells he presented the observed effects. Several „resonant“ frequencies around 51 GHz have been recorded, showing an increasingly narrowing frequency bandwidth with a decrease of the transmitted power (up to 10-17 W/cm²). The results were interpreted as an alteration of the DNA folding structure. Because of the low radiation intensity according to the author, we may only assume a quantum mechanical effect. His own model of mechanisms of „Electron-conformational Interaction“ from 1996, however, was not mentioned.

The papers of E.A. Kovacz from the Medical University Bukarest and of E. Unger from the Institute for Molecular Biotechnology Jena presented studies on the impact of relatively strong EMF on biological systems. E.A. Kovacz, supported by H. Berg from the Virological Institute

Jena, examined the behaviour of photo receptors of the eye retina in static and periodical electric fields (10-1500 kHz). Field powers were 400 V/m up to 200 kV/m. From the obtained results the authors derive conclusions on the dielectric properties and the living ability of cells during exposure. E. Unger presented a study on the influence of EMF on cell structures participating in cell stabilization (microtubuli). He demonstrated that microtubuli can be directed and moved by strong electric fields.

The third and last day of the symposium primarily dealt with possible medical applications of EMF. Non-invasive methods of temperature measuring combined with hyperthermal treatment, new therapies for the treatment of skin alterations (such as warts, tumors) using non-ionizing radiation in the visible wave spectrum (photodynamic therapy) as well as medical progress concerning the microwave-resonance therapy in the Ukraine were presented by J. Vrba from the Technical University Prag, M. Jirásková from the Research Department for Dermatology of the Karls University Prag and B. Grubnik from the Scientific Research Centre for Quantum Medicine Kiev.

The to date unpublished results concerning effects of electromagnetic fields presented at the symposium now will have to be repeated by independent scientists. In the area of possible mechanisms no new insights were given. Not least because of the absence of some referees certain lectures were characterised by in-detail depictions of the own working organisation und life philosophy, not necessarily a benefit for the event.

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