

INTERACTIONS BETWEEN FIELDS AND RADIATIONS WITH LIVING MATTER, MEDICAL AND BIOLOGICAL APPLICATIONS

ABSTRACT

The doctoral thesis "The response to irradiation with pulsed electromagnetic field (PEMF) of biological systems at cellular and subcellular level" began by defining the goals and working hypotheses, the standardization of methods, materials and tools used; ethics of research on laboratory animals, knowing their normal and pathological biology.

Reassessment of knowledge has been done in the cellular and subcellular biological systems, morphological and electrophysiological characteristics, the endogenous electromagnetic cellular states, of structures and functions of the colloidal biological medium, phases and cell membranes, characteristics of movements and phenomena electrokinetic endogenous, transport processes of ionophore; conductivity, reography, magnetograms. We have analyzed the main physical characteristics of PEMF, the diagram of PEMF - cellular systems interaction, the absorption, the dispersion, the reflection, the refraction and the interference. It has tackled the issue of systemic interaction PEMF - cellular and subcellular systems, the generation of information, adaptation, and memorization. It was added to the theory of classical electrodynamics, the informational membrane transport protocol, introducing the signals as a simultaneously carrier of the electrical gradient and of the information.

In the "Special Part" the working hypotheses are formulated; two experiments are performed, one on white mice and other in cell cultures. in the first experiment: the algorithm, the biological material, the devices and the materials, statistical results, photographs of microscopic preparations produced by the treatment BLM + PEMF are exposed compared to the BLM alone and witness. The second experiment, cell Hep2 materials and methods, results. The conclusions of experimental part and of the thesis are exposed

I have dealt with problems of the Bioelectromagnetics compatibility, the electromagnetic ecology, the hyper- exposure of human to EMF, creating a new fabric and screen protection in the microwave, the creation of biotechnologies for treating plants, the studies and research regarding the electromagnetically modulation of cell and the tissue activity as: a sterilization of the surface and volume with soft x ray, the PEMF generators of high and medium power for the study and modulation of cellular events, for the cytolytic and cytostatic effects, the sterilization with electric field of high voltage for liquids and semisolid and biologically contaminated objects.

For tissues, we designed and built the tomoimpedancemeters, phantoms biological - like; I patented a method and apparatus for a targeted electromagnetic vehiculation of substances. In nanotechnology we have designed, synthesized, experienced and patented the nano-granular biomaterials, magnetite-2-deoxy-D-glucose to use in imaging and anti-tumor therapy; I worked with a multinational team, leading a project synthesis, bio-passivation and activation of magnetite nanodots coated with radioactive strontium.

I approached the study and promotion of new concepts such as the biological channel and the algorithm of bioelectromagnetics investigation, I have contributed to the foundation and temporarily I led Electromagnetic and Bioelectromagnetics Compatibility Laboratory from ICPE-CA Bucharest.

The doctoral thesis in radiotherapy, "Efficiency of radiotherapy in solid tumors of soft tissues (STM)" started with a pilot study which guided our research from a classical clinical approach to a systemic approach, centered on the relationship tumor-host, on their domain of coherence functional and structural, the organization, the morphometry and the segmentation of the tumor-host complex, the dynamics of sarcogenesis, watching in fact the study the effectiveness of radiotherapy.

In the "Special Part" of the thesis, I have defined the aims, the working hypotheses, the patients and methods, the results and conclusions of the paper. Subchapter "Patients and Methods"

consisted of epidemiological research, the study the association between the variables, the degree of correlation between the groups studied by us and STM in Romania, from the same period; there have been described the statistical characters of researched group, the surgery treatment and radiotherapy.

Preliminary results and conclusions were analyzed in terms of pre-treatment characteristics and these following therapies. The pre-treatment characters analyzed was: the debut declared by patient, age, sex, location, pathological characteristics, tumor morphometry, valued at groups that had different types of sarcomas.

Characteristics following therapy: therapeutic measure of efficiency, survival and quality of life, depending on: sex, age, therapeutic associations, localizations and histopathology, relationships tumor - host; the degree of association and significance levels of the association, depending on the biological cost / therapeutic efficacy. The chapter was closed with the conclusion of this study.

The paper concludes with two annexes (Annex 1) which is trying, based on the results of statistical processing and the systemic approach of the phenomenon of sarcogenesis, to do an operational statistical analysis, needed to build a mathematical model of the paper (Annex 2).

I continued the study and research in optimization of radiotherapy, leading research projects as: the reduction of the effects of ionizing radiation on healthy tissues, hadrontherapy, HIFU, improving diagnostic imaging; increasing the quality of teaching in radiotherapy through multilevel assisted computational learning models.

In collaboration with JINR Dubna, CERN; ICPE-CA, IFIN HH, IFTAR, INFLPR, INFIM, ICI and UMFC, I approached the hadrontherapy as it follows: treatment of five patients, research projects in radiobiology, radio-physics, dosimetry, technology and treatment techniques, organizing education and introduction hadron therapy in national research plan, organize workshops and international conferences in the field, organizing and conducting the Romanian Society for Hadrontherapy, international collaborations, feasibility studies for protontherapy.

Also in order to optimize cancer treatment I have implemented HIFU (High Intensity Focused Ultrasound) in Romania; I have treated 40 patients, I developed an optimization of planning, I promoted the elementary tumor unit concept at ISMINIM (International Society For Non-Invasive And Minimally Invasive Medicine) of leadership which I was part.

I drove in imaging, the research projects that had next themes: differentiation between benign and malignant tumor lesions, intraoperative detection of positive tumor margins, nanodots for diagnostic and anti-tumor therapy, tomoimpedancemeters. I patented and we communicated the results.