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SPECIAL CHARACTERISTICS OF THE INTERACTION OF ELECTROMAGNETIC FIELDS WITH BIOLOGICAL ENTITIES

Moscow OSOBENNOSTI VZAIMODEYSTVIYA ELEKTROMAGNITNYKH POLEY S BIOOB'YEKTAMI (Special Characteristics of the Interaction of Electromagnetic Fields with Biological Entities) in Russian 1978, pp 5-9

[Foreword by the editors, Professors B. M. Savin and G. A. Stepankiy, and table of contents from book by V. M. Shtemler and S. V. Kolesnikov]

[Text] The problem of the biological effects of radio-frequency electromagnetic fields has become particularly urgent in recent years. As a result of the rapid development of radio communications, radar, and television, a considerable part of the earth's population is constantly exposed to electromagnetic radiation of the radio-wave range. The wide use of electromagnetic energy in the national economy, science, and medicine is accompanied by further increase in the number of persons exposed to hygienically significant levels of electromagnetic radiation with various characteristics: from quasi-static radiation to radiation of the optical band.

Devices which are sources of radio waves are extremely useful to man, however, when used without proper control, they create extremely high levels of radiation and can be hazardous to human health. This determines the special significance of problems of hygienic normalization of radio-wave radiation in solving problems of ensuring safe working conditions and environmental protection.

It should be noted that the Soviet Union is the first country in the world where the levels of radio-frequency effects were regulated by the government.

In recent years, international attention to the problems of the biological effects of electromagnetic radio-frequency radiation and its hygienic normalization has increased considerably. The formation of the International Committee on Nonionizing Radiation within the framework of IRPA (International Commission on Radiological Protection) is significant in this respect. The tasks of the committee include the analysis of the biological effects of various types of nonionizing radiation, as well as the development of recommendations for the maximum permissible levels of radiation and normative documents of international nature. Just since 1973, the time of the first

1

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JPRS-15

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large-scale international symposium "Biological Effects of Microwaves and Health Hazards," 15 international forums were held on various aspects of this problem.

The problem of the biological effects of electromagnetic radiation of the radio-wave range is one of the main divisions of the radiobiology of non-ionizing radiation, which is an independent area of scientific knowledge. It includes a number of scientific directions connected with the establishing of regularities in the responses of live systems to the effects of radio waves at various levels of their organization: subcellular, cellular, systemic, and the organism level.

Being engendered primarily by practical needs -- the necessity of preventing the unfavorable effects of this type of radiation on the human organism, as well as the interests of clinical medicine (particularly, physiotherapy) -- in recent years, it has been increasingly acquiring a heuristic importance, contributing to the discovery of the most intimate vital activity processes of the organism.

Although the first studies on the biological effects (therapeutic) of electromagnetic radiation of the radio-frequency range were done as early as the end of the last century, a systematic development of this problem was started only at the end of the forties.

At the present time, the bibliography on the problems connected with the biological effects of electromagnetic radio-frequency fields has several thousand titles. Nevertheless, a considerable part of them are descriptive in nature and deal chiefly with phenomenology. Only in recent years there has developed a definite tendency toward increasing the number of publications treating special characteristics of the absorption and distribution of the energy of electromagnetic fields in biological entities, and the investigation of the intimate mechanisms of their action, as well as the improvement of research methods and experimental techniques.

This collection was prepared by the members of the laboratory of electromagnetic radio-frequency waves of the Institute of Labor Hygiene and Occupational Diseases of the USSR Academy of Medical Sciences.

The surveys contained in it are dealing with three key aspects of the problem: its clinicohygienic aspects, effects of radio-wave radiation on the central nervous system, and biophysical aspects of the interaction of electromagnetic fields with biological entities.

The correct estimation of the hazards of radio-frequency radiation and extrapolation of the data of experimental studies conducted on animals in application to the human organism are possible only on the basis of the establishment of a strict interrelation between the incident energy and the energy absorbed by the biological entity, between the electromagnetic fields which are really acting (induced in the biological entity) and the biological effects occurring at that time. These problems are discussed in the first survey of the collection.

2

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Until recently, very little was known about these problems. It is very recently that considerable progress has been made in this area, which has created the prerequisites for a more correct evaluation of the results of experimental studies. There is no doubt that the authors of this survey had a difficult task of making the problems of the interaction of the electromagnetic field with a biological entity accessible for broad sections of medicobiological specialists without resorting to the comparatively complex mathematical apparatus. The authors limited themselves to a minimal number of formulas which, at the same time, make it possible to perform practical computations extremely important in planning the experiments and analyzing the results of the studies.

The next survey analyzes the works dealing with the effects of radio waves on the activity of the central nervous system. It should be mentioned that the largest number of works published in recent years are dealing with this problem. This is quite understandable because the accumulated data indicate that the central nervous system is one of the systems of the organism which is the most sensitive to the effect of electromagnetic fields of the radio-frequency range, and changes in the indexes of its functional state are considered to be of decisive importance in substantiating the thresholds of harmful factors.

As has been mentioned above, the problems of hygienic normalization of radio-wave radiation have become particularly urgent in recent years. In this connection, the concluding survey, along with the discussion of the published data on the clinical manifestations of radio-frequency effects, gives information on the exposure standards adopted in various countries, modern approaches to the hygienic evaluation of factors, measurement methods, and levels of radiation to which people are exposed under industrial conditions and in everyday life. It should be mentioned that, in spite of the great importance of these problems, the number of publications treating them is rather limited, and most of them belong to Soviet authors.

It is notable that the number of works by foreign authors on the methodology of hygienic standardization is extremely limited in spite of the fact that it is in this problem that there are substantial differences both in the treatment of clinical changes connected with the effects of this factor, and in the exposure levels permitted by the standards of various countries.

This collection is intended primarily for scientists engaged in research on the problem of nonionizing radiation. However, it is believed that the materials contained in it will also be of interest for broader sections of medical and radio engineering specialists.

Contents

	Page
Introduction	10
Electrical and Magnetic Properties of Biological Tissues	12

3

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General Regularities of the Interaction of Electromagnetic Fields (EMF) with Biological Entities	18
Interrelation of External and Internal Fields. Absorption and Distribution of Energy in Bodies of Various Shapes and Dimensions	24
Low-Frequency Region (Quasi-Static Approximation)	24
Spherical Models	25
Spheroidal Models	32
Special Models Used in the Ultralow Frequency Range	38
Nonlinear Absorption Region	41
Spherical Models	41
Spheroidal Models	45
High-Frequency Region	48
Plane-Layer Models	48
Irradiation in the Field of an Unformed Electromagnetic Wave	49
Methods and Results of Measurements of Internal Fields and Absorbed Power in Phantoms and Biological Entities	50
Methods of Measuring the Integral Absorbed Power	50
Measurement of the Internal Distribution of Fields and Absorbed Power by the Probing Methods	51
Measurement of the Density of the Absorbed Power in Biological Phantoms and Animals by the Thermographic Method	52
The Problems of EMF Dosimetry in Experiments and Extrapolation of the Data Obtained in Experiments on Animals to Man	58
Conclusion	62
Bibliography	64
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10,233

CSO: 8144