

# **MOLECULAR AND PHYSIOLOGICAL MECHANISMS OF THE INTERACTION BETWEEN HIGH-ENERGY HEAVY IONS AND BIOLOGICAL STRUCTURES**

E.A. Krasavin

*Joint Institute for Nuclear Research, Dubna*

Studying the regularities and mechanisms of the biological action of high-energy heavy charged particles (HCP) coming from the Galaxy depths is one of the extremely topical issues of cosmic biology and medicine. During long missions beyond the Earth's magnetosphere, spacecraft crews will be chronically exposed to accelerated heavy ions of a wide energy and charge range. This exposure can lead to the development of a number of harmful consequences for the organism, among which are increasing the risk of cancer development, frequency of gene and structure mutations, disorders of the visual apparatus functions (cataract development and retina damage), and central nervous system structure damage. The special features of the disorders of a number of physiological mechanisms associated with the organism exposure to HCP are caused by the specifics of the high-energy heavy ion energy transfer to biological structures: much energy is released in a small tissue volume.

At the accelerators of the Joint Institute for Nuclear Research (JINR) in Dubna, investigations aimed at modeling the biological action of heavy nuclei of the galactic cosmic radiation have been performed for more than 40 years. Studied are mechanisms of the lethal and mutagenic action of multi-charged ions on different organisms' cells; molecular mechanisms of a cataract formation caused by the action of radiations with a wide range of the linear energy transfer; HCP damaging action on the retina and central nervous system tissues; and blastomogenic effects of corpuscular radiations. Using accelerated heavy ions, one of the central problems of the cosmic radiation biology was solved: the problem of the relative biological effectiveness of radiations. JINR's unique nuclear physics installations allow solution of multi-aspect problems related to the radiation safety of crew members on long interplanet missions and crew members of long-range and high-altitude aviation.