

## **A review of the project "Research on the Biological Effect of Heavy Charged Particles with Different Energies" proposed for realization at the Joint Institute for Nuclear Research in 2018—2020**

The project suggests continuation of the studies underway at JINR's charged particle accelerators. In the past period, radiobiological research yielded unique results. A large series of research on the induction and repair of DNA damage was completed. The clustered character of the damage induced by accelerated heavy charged particles was studied. Radiation-induced morphological and functional changes in the eye retina of small laboratory animals were studied; retinal capacity for cellular and functional recovery was established. The action of accelerated carbon ions on the metabolism of the key neuromediators of the rodents' brain was studied. The most radiation-sensitive regions of the brain were identified, where metabolism changed at early and late times after radiation exposure. Developed were a mathematical model of the ultraviolet-induced mutation process in repair-deficient bacterial cells and a model of DNA double-strand break repair in higher organism cells after exposure to ionizing radiation of different quality. A new radiation risk concept for interplanetary flights was proposed, associating the radiation risk for crew members mainly with the action of heavy nuclei of the galactic cosmic rays on the central nervous system (CNS).

Further research is going to be a complex study of the regularities and mechanisms of the action of accelerated heavy particles at the molecular, cellular, tissue, and organismal levels of biological organization. Of special interest is continuation of radiation physiology research, which is extremely important as regards solving the tasks faced by space radiobiology. The data obtained on the development of radiation syndromes due to the exposure of brain structures to ionizing radiation, which result in the violation of brain integrity, allow considering the CNS as the "critical" system for the evaluation of the cosmonauts' radiation exposure risk in the interplanetary flights. Fruitful active research in this field is jointly conducted by specialists of the Laboratory of Radiation Biology (JINR) and the Institute of Biomedical Problems (the Russian Academy of Sciences).

In view of the above, I find the research proposed by the reviewed Project to be of a fundamental character and urgently important for solving a broad range of applied problems.

Acad. O.I. Orlov

Director

Institute of Biomedical Problems, Russian Academy of Sciences