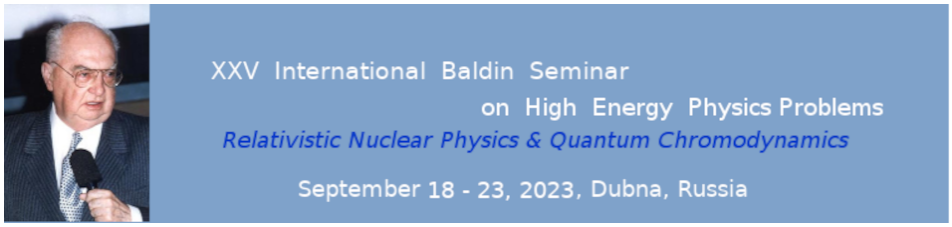

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Radiobiological research on heavy ions in LRB JINR

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Radiobiological research in Laboratory of Radiation Biology focusses on addressing both fundamental and applied problems of modern biology and medicine and relies on the availability at JINR of a wide range of radiation sources, including beams of heavy ions of various energies.
In the context of fundamental aspects, our research focusses on understanding of the key physical and biological mechanisms that are responsible for the detrimental effects of radiation at various levels of biological organisation. These studies involve consideration of radiation energy deposition in biological targets, induction of various types of radiation induced damage, the role of biological repair system, the effects of radiomodifying agents etc. One of the milestones achieved in LRB is the solution of so-called RBE (Relative Biological Efficiency) problem. Our scientists clearly demonstrated that the character of RBE dependence on LET (Linear Energy Transfer) of radiation is determined by factors of both physical and biological nature, namely the spectrum of energy deposition in the target volume and the type of critical biological lesions and the ability of cells to repair these lesions. Radiobiological studies with accelerated ions exploiting modern techniques for the detection of molecular and structural DNA damage provided a crucial contribution to the discovery of so-called clustered DNA lesions that are critical events in eukaryotic cells.
The applied aspect of radiobiological studies is associated with the area of radiation tumour therapy and evaluation of radiation risk in space exploration. Despite recent technological improvements in tumour radiotherapy that were achieved through optimisation of dose distribution fields and the use of high RBE particle radiation, the scope for further advances in this area is limited. However, an opportunity for further improvement of radiotherapy remains by exploiting biological factors. One of such approaches is the application of radiosensitising agents aiming to increase the radiosensitivity of tumour cells. In LRB, in vitro and in vivo studies with DNA synthesis inhibitor AraC (cytosine arabinoside) demonstrated an increase in DNA damage, cell death and suppression of model tumour growth after irradiation following application of this agent. Other agents that interfere with cellular DNA repair systems to enhance radiosensitivity are currently under investigation.
In the context of radiation risk assessment in the area of space exploration, the consequences of radiation damage to CNS (central nervous system) from galactic cosmic rays, consisting of high energy protons and high charge and energy ions, are considered as a critical factor. Understanding the initial events and mechanisms of these effects is the main objective of research in this area. To achieve this aim, studies are underway in LRB that include investigation of behavioural reactions of irradiated animals, pathomorphological changes in different parts of the brain, neuroinflammatory processes in microglia that are responsible for radiation-induced neurodegenerative changes in CNS.
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