

Local dose and its role in the biological response of mammalian cell lines *in vitro*

Abstract

The radiobiological effects of charged heavy particles on a cellular or molecular level are of fundamental importance in the field of biomedical applications, especially in hadron therapy. This dissertation focuses on the analysis of two issues: the local dose of carbon ion beam, obtained in radiobiological research at the Heavy Ion Laboratory of the University of Warsaw (HIL) and its role in the biological response of mammalian cells *in vitro*.

Before the radiobiological studies started, the local dose was characterized and dosimetric tests were conducted. The beam dosimetry at HIL is based on single-particle counting, registered by an independent Si-detectors system. For the verification of the dosimetry and homogeneity of the irradiation, studies with the use of physical methods were conducted, including self-developing dosimetry Gafchromic® EBT2 films and the Solid-State Nuclear Track Detectors PM-355, as well as the biological γ -H2AX assay. Quantitative analysis of the results confirmed the proper functioning of the dosimetric system used in the tested setup.

In the dissertation the radiation-induced bystander effect was also analyzed. For that purpose the biological response of the nonirradiated cells, that have been cultured with cells irradiated with ^{12}C ion beam or X-rays was examined. In the analysis, the two complementary radiobiology tests were used: micronucleus assay and clonogenic assay. The results showed no bystander effect in the examined experimental system.