Cells ability to move is necessary for proper functioning of the organisms. During embryonal development, cell migration enables tissue and organ formation and their appropriate localization. Further in the development, thanks to active movements immunological system cells can pursue pathogens to destroy them and defend the organism.

Unfortunately, there is also the ‘dark side’ of cell motility, which reveals itself in cancer. One of the fine examples are gliomas – malignant tumors of central nervous system, that demonstrate exceptional ability to spread into healthy tissues and create metastases. Due to this particular feature which significantly hinders glioma treatment this, tumors have become the subject of this project. Among numerous proteins influencing migration, Rac1 deserves special attention as it regulates adhesion proteins, cell cytoskeleton structure and reorganization of the frontal part of migrating cell. Latest research show that Rac1 proteins resides also in the cell nucleus, where they affect nuclear organization. Moreover, the cell nucleus itself – the biggest and the heaviest organelle - has also been pointed as a key component playing an important role in transferring mechanical signals during cell movements. The shape, size, location and plasticity of the nucleus influence the speed and directionality of cell movements, therefore regulating the efficiency of migration.

Therefore the aim of the study is to reveal the role of nuclear Rac1 protein in regulation of glioblastoma cells migration mediated by mechanical and signaling properties of the cell nucleus. During the experiments fluorescent biosensor of Rac1 activity will be introduced into immortal glioblastoma cell lines originating from human glioblastoma tumors. It will allow us to determine the level and distribution of active Rac1 protein with fast time-lapse microscopy. Subsequently, we will describe the relation between active Rac1 nuclear level, structure and mechanical properties of the nucleus as well as cells ability to migrate. In order to achieve this goal fluorescently labelled nuclear components will be visualized with 3D/4D confocal microscope and live migrating cells will be observed for a long time with bright field microscope.

Identification and characterization of mechanisms which enable cancer cells to use migration in order to invade new tissues will aid in development of more efficient therapies in the future.