

Modulation of cell migration with magnetic translocation of nucleus.

Cell migration, which is defined as the movement of the cells from one place to another, plays the key role in many physiological processes, such as gastrulation, neurons growth and development, wound healing or tissue engineering. Abnormal cell migration is also the reason of some diseases, for example immune disorders, tumor metastasis or congenital heart and brain abnormalities. Because of that, the knowledge of mechanisms which are regulating cell migration is significant for science and medicine. In the past, the role of the nucleus in a cell movement has been underestimated. However, current studies claim that position of the nucleus during cell migration is not random. Moreover, more contemporary studies suggest that that is an actively regulated process which plays a key role in directed cell movement.

The aim of the project is to estimate how mechanical manipulation of nucleus influences cells migrating on substrates of different elasticities. Preliminary experiments showed that magnetic beads, which are injected into the cell nucleus, are moving in external magnetic field along field lines. Since cell nucleus is the most rigid organelle, nanoparticles are remain inside the organelle, while pushing the internal nucleus membrane and causing its movement. Based on literature, it is expected that the movement of the nucleus will have an impact on the whole cell behavior and, especially, it can influence cell migration through the connected cytoskeleton.

The proposed research aims at answering the question whether the change of the shape and position of the nucleus, which are an indispensable part of cell migration process (especially during the cell polarization), is the cause or the result of the process itself. The main aim of the project is to establish a proper measuring method – a magnetic cell nucleus manipulator, which could be used for future research on the influence of a magnetic field on living cells.