Cancers are one of main civilization diseases bothering modern society. Within past few decades there was a huge progress done forefront in the field of cancer treatment. However, direct knowledge of disease origins mechanisms remains unknown. To be able to successfully fight with such complex process like metastasis progression, knowledge about such mechanisms is crucial. Under the influence of transformation cancerous cells become malignant i.e. more harmful and capable of relocation within blood stream and causing new outbreaks in patients organism. To allow movement among humans body, cancerous cells need to create connections with its environment, extracellular matrix. This way both cancerous cells influence their surroundings, and they are subjected to changing pressure, pH, chemical composition. In order to sense external stimuli, cells utilize membrane receptors, among which very important are integrins binding to extracellular matrix. Assessment of properties and adhesion parameters of such connections will yield in understanding of cancer progression.

There are many possibilities to conduct adhesion properties measurements, among which we choose two complementary methods: single cell force spectroscopy (SCFS) and traction force microscopy (TFM). Both methods allow scrutiny of in vitro cell behaviour on elastic polymer layers of distinct elasticity covered with extracellular matrix proteins. Such kind of surfaces have great advantage, namely we can produce them easily with elasticity values close to native cancerous cells' environment. Together with temperature control and medium composition, it enables maintenance of conditions possibly closest to native ones.

SCFS is relatively new technique based on atomic force microscopy (AFM) suitable for very precise surface assessment. Normally, several nanometer diameter probe is maintained over the scrutinized object surface on very small height and then retracted. Obtained force versus displacement curves allow to conclude on the adhesion force value generated between probe and studied surface, provide information about the sample topography and it's mechanical properties (elasticity). In our relatively new approach, rigid probe is replaced with a living cell to be approached to the surface covered with fibronectin or vitronectin, extracellular matrix proteins taking part in adhesion. Such kind of experiment performance enables both assessing single membrane receptors-proteins unbinding force and total adhesion of bladder cancer cells of different malignancy levels.

TFM is a complementary to SCFS method based on registering caused by cells motility translocations of fluorescent microspheres planted in elastic polymer gels. Similarly to previous technique, we will use substrate covered with fibronectin and vitronectin. Three different grade malignant and one non-malignant cell lines assessed this way will serve to obtain the movement patterns and pressure exerted by cells on their environment during cancerous transformation.

Results obtained in described way will be compared with fluorescent images of cytoskeleton, cells internal scaffold responsible for the shape and adhesion to the external environment. All the data together will be utilized to provide better understanding and explanation of changes occurring in living cells under cancerous transformation. It is crucial that environment affects the malignancy level of cells since some of genetically same cells transform and some of them stay non-malignant. Understanding of this phenomenon may facilitate diagnosis and prognostics and hence eventually improve cancer treatment.