Detecting cancer by probing the elastic properties of cells

Małgorzata Lekka

The Henryk Niewodniczański Institute of Nuclear Physics,
Polish Academy of Sciences,
Radzikowskiego 152
31-342 Kraków, Poland.

A major problem in cancer management is metastasis – the ability of the primary tumor cells to migrate by way of the blood or lymph vessels and to form tumors at multiple, distant sites. Recent progress in the study of cancer cell motility and invasion has generated a greater understanding of the mechanical properties involved in malignant transformation. There are evidences that cancer progression is characterized by disruption and/or reorganization of cytoskeleton (i.e. a cellular scaffold). This is accompanied by various molecular alterations influencing the overall mechanical resistance of cells.

Current approach of diagnosis focuses mainly on microbiological, immunological and pathological aspects rather than on the biomechanics of diseases. The determination of mechanical properties of an individual living cell has became possible with the development of such local measurements techniques such as an atomic force microscopy (AFM), magnetic or optical tweezers. The advantage of them lies in the capability to measure living cells at a single cell level and in liquid conditions close to natural environment. The quantitative analysis of cell deformability between normal (reference) and cancerous cells and, more precisely, their characterization (qualitative and quantitative) can have a significant impact on the development of methodological approaches towards precise identification of pathological cells and would allow for more effective detection of cancer-related changes.