Contribution ID: **7** Type: **not specified**

Mechanical properties of circulating tumor cells as markers of metastatic activity

Thursday, 19 March 2026 10:30 (30 minutes)

During the transformation of a tumor cell into a metastatic cell, a number of radical transformations occur, in which changes in mechanical properties play a key role, in particular, the loss of epithelial intercellular contacts, cytoskeletal reorganization, cell shape change, and a series of events that include the crossing of barriers. So, the mechanical properties of the cell membrane change significantly and are crucial at each stage of the metastatic cascade. Therefore, the study of the mechanical properties of tumor cell membranes may open new avenues for diagnostics, as well as antitumor and antimetastatic therapy.

The micropipette aspiration method was used to determine the mechanical characteristics of the cells. This method allows non-invasive measurement of the integral macroscopic elastic characteristics of cells during their suction into the micropipette capillary due to the reduced pressure in it. The work shows that cells grown in a deadhesive manner have a more homogeneous population compared to adhesive ones, and are also characterized by a smaller range of surface elastic modulus values. LLC cells are characterized by a lower surface elastic modulus than LLC/R9 cells, which correlates with the metastatic activity of the cells. The mechanical parameters of cells obtained in the work can be useful as specific markers for establishing the metastatic potential of tumor cells, for diagnosing metastatic cells, for developing new strategies and antitumor (antimetastatic) therapy.

1. M.V. Olenchuk, O.P. Gnatyuk, S.V. Romanenko, P.V. Belan, D.L. Kolesnik, G.I. Solyanik, G.I. Dovbeshko "Mechanical properties of the membrane of circulating metastatic tumor cells as a diagnostic marker" was accepted into the journal "Low Temperature Physics" in 2026.

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