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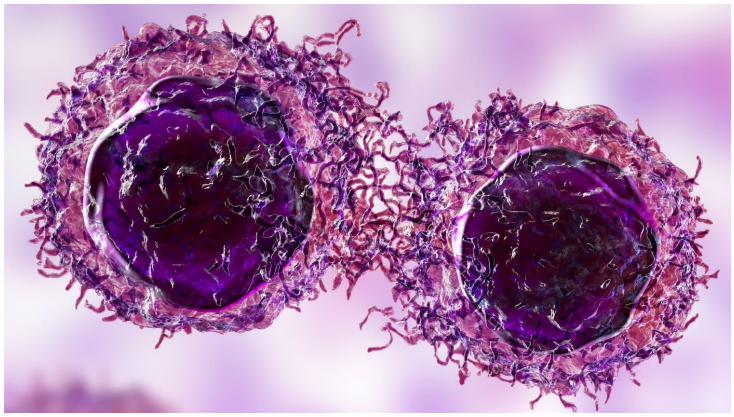
Scientists at IISc tweak cancer cell response to ultrasound treatment

18 February 2025 | News

Extracellular matrix spacing of 50â??70 nm induces cancer cell death upon ultrasound treatment



Cells have surface receptors called integrins that bind to repetitive domains present on the extracellular matrix (ECM) surrounding the cells, allowing them to grow and spread. A new study from the Department of Bioengineering (BE), Indian Institute of Science (IISc), Bengaluru and collaborators shows that tweaking the spacing between these binding domains on the ECM can boost the efficiency of ultrasound treatment applied to kill cancer cells.

Low-frequency ultrasound waves (39 kHz) can disrupt the cell membrane and trigger cell death in cancer cells. It is a relatively low-cost and non-invasive approach. Unlike normal cells, cancer cells do not have repair mechanisms that help them withstand the mechanical forces exerted by ultrasound waves.

To mimic the integrin-ECM binding, the team constructed an array of gold nanodots separated by different distances (35, 50 and 70 nm) and allowed highly invasive cancer cells to attach to them. Then, they applied pulsed ultrasound waves.

When ultrasound was applied to cancer cells grown on the 50 nm and 70 nm platforms, their cell membranes were found to stretch due to forces exerted by a filament protein called myosin. More extracellular calcium is then pumped into the cytoplasm, which damages mitochondria and promotes cell death.

The team has collaborated with clinicians to test this combination approach on oral cancer tissue samples.