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Measuring the cytoskeletal properties of cell cultures using high-frequency ultrasound CAITLIN CARTER, TIMOTHY DOYLE, Utah Valley University — High-frequency ultrasound (10-100 MHz) has been demonstrated to be sensitive to cell cytoskeletal changes. Cytoskeletal properties determine the biomechanical characteristics of cells and their role in many biomolecular processes. Examples include the aggressiveness and metastatic potential of breast cancer subtypes, T-cell activation during immune responses, and microtubule disintegration in Alzheimer's disease. The objectives of this work were to optimize the use of high-frequency ultrasound to subtype breast cancer cells and to acoustically measure cytoskeletal modifications. Pulse-echo measurements of 7 breast cancer cell lines of different molecular subtypes were acquired over a 2.5-year period using a 50-MHz transducer immersed in the growth media of monolayer cell cultures. Cell reflections were isolated from the interfering cell-culture plate reflections, spectrally analyzed using Gaussian curve fits, and spectrally classified using a heat map. The heat map displayed distinct patterns that differentiated the cell lines by molecular subtype. Cell cultures were also treated with colchicine and sphingosylphosphorylcholine to observe modulation of the microtubule and actin components. Cell waveforms and spectra displayed time-dependent changes due to chemical modification of the cytoskeleton. These results further verify and improve the noninvasive use of high-frequency ultrasound to differentiate breast cancer subtypes and to monitor cytoskeletal alterations in real time.

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