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Optical Interferometric Response of Living Tissue to Cytoskeletal Anticancer Drugs DAVID NOLTE, KWAN JEONG, JOHN TUREK, Purdue University — Living tissue illuminated by short-coherence light can be optically sectioned in three dimensions using coherent detection such as interferometry. We have developed full-field coherence-gated imaging of tissue using digital holography. Two-dimensional image sections from a fixed depth are recorded as interference fringes with a CCD camera located at the optical Fourier plane. Fast Fourier transform of the digital hologram yields the depth-selected image. When the tissue is living, highly dynamic speckle is observed as fluctuating pixel intensities. The temporal autocorrelation functions are directly related to the degree of motility at depth. We have applied the cytoskeletal drugs nocodazole and colchicine to osteogenic sarcoma multicellular spheroids and observed the response holographically. Colchicine is an anticancer drug that inhibits microtubule polymerization and hence prevents spindle formation during mitosis. Nocodazole, on the other hand, depolymerizes microtubules. Both drugs preferentially inhibit rapidly-dividing cancer cells. We observe dose-response using motility as an effective contrast agent. This work opens the possibility for studies of three-dimensional motility as a multiplexed assay for drug discovery.

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