Biodynamic Imaging: Doppler “Radar” of Cellular Motions inside Living Tissue

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In living tissue, everything moves, and everything scatters light. Therefore, light scattered from living tissues carries a wealth of information about cellular dynamics and the state of health of tissue as it responds to its microenvironment. Biodynamic imaging is a new biomedical technology that uses low-coherence light, combined with digital speckle holography, to measure intracellular motions inside living tissue up to a millimeter thick. The mechanisms of pharmaceuticals on tissue is captured in drug-response fingerprints through tissue dynamics spectroscopy. The physical and physiological basis for biodynamic imaging is explained, and the potential to use biodynamic imaging to select chemotherapy for personalized cancer care is discussed.

Motility contrast image of a multicellular tumor spheroid about 0.8 mm in diameter. The proliferating shell surrounds a hypoxic and necrotic core.