FLUORESCENT VISCOSITY PROBES AS DIAGNOSTIC TOOLS FOR CANCER DETECTION

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Viscosity is a key characteristic of biological membranes – it governs the passive diffusion of solutes and affects the lipid raft formation and membrane fluidity. Moreover, viscosity measurements provide a convenient way to observe the compositional changes that take place in biological membranes and organelles, as the efficiency of lipid packaging and the order of lipids have a great influence on the viscosity values of lipid structures.[1] In this work, we explore the viscosity-sensitive dyes, called molecular rotors,[2,3] as diagnostic tools for cancer detection. Through the use of fluorescence lifetime imaging microscopy (FLIM) in combination with organelle-specific BODIPY dyes, whose fluorescence lifetimes increase with increase in microviscosity, we investigate the order of lipids in lysosomes and lipid droplets of cancerous and non-cancerous live cells. Our results demonstrate that lipid droplets in cancerous cells have vastly different lipid packaging efficiences between different cells in the same culture. In contrast, we show that lipid packaging efficiences of lipid droplets are uniform in non-maligant cells. Finally, we demonstrate that both lysosomes and lipid droplets in maligant cells possess up to 3 times greater microviscosities compared to non-maligant cells.

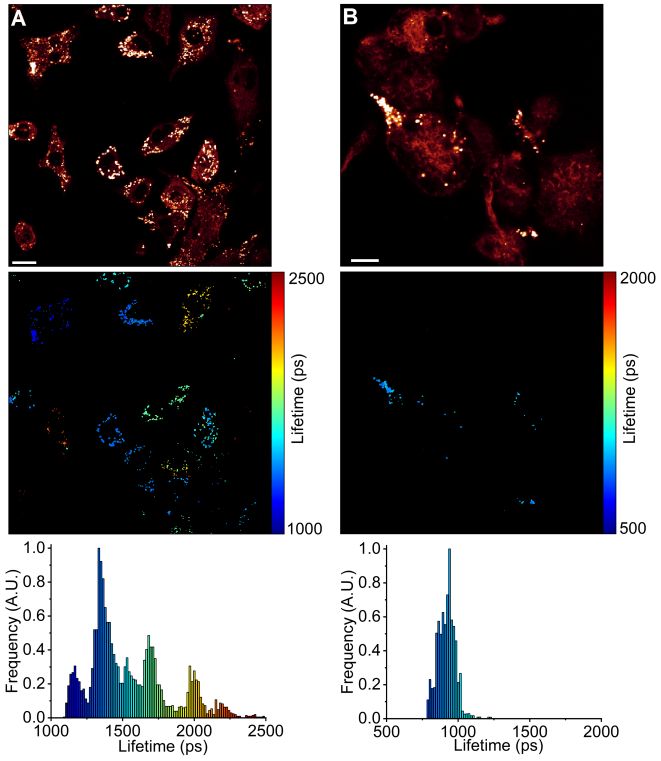

Fig. 1. FLIM of BODIPY-LD in lipid droplets of human lung cancer A549 cells (A) and human embryonic kidney HEK 293T cells (B). The top panel shows images of fluorescence intensity. FLIM images are shown in the middle panel. The corresponding lifetime histograms are shown in the bottom panel. Scale bars are 10 μm.

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