Effect of Sucrose on Directional Motions of Cholesterol Crystals Surfing on a Lipid Membrane

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Cholesterol crystallization within membrane environments involve a complicated interplay of cholesterol molecules with surrounding phospholipids, cholesterol molecules, and water layers. Using a mixture of phospholipid and cholesterol at supersaturating concentrations, certain directional movements of cholesterol crystals were demonstrated. Using epifluorescence microscopy, the gradual solvent exchange from a 50% organic medium to an aqueous buffer producing supported lipid bilayers with multiple types of three-dimensional cholesterol crystals undergoing different pathways of evolution was observed. Moreover, by using a 30% Tris-sucrose buffer, this experiment observed how sucrose affects the previously documented 5 distinct trajectories of “parking”, “curve”, “spiral”, “back-and-forth”, and “circle”. The decrease in movement and growth caused by sucrose was also observed. Under the speculation that the attraction between cholesterol crystals and surrounding molecules drives crystal growth and movement, this experiment proved that the influence of sucrose on such interactions can affect the directional motion of cholesterol crystals. Therefore, this study can help develop the understanding of interactions within the cell membrane and lipid nanoparticle (LNP) vaccines, which are widely used to prevent the spread of the COVID-19 pandemic.