

# A minimal lattice model of lipid membranes with liquid-ordered domains

Tanmoy Sarkar<sup>1</sup> and Oded Farago<sup>1</sup>

<sup>1</sup>*Department of Biomedical Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel*

Binary or ternary mixtures of lipids and cholesterol featuring liquid-ordered (Lo) domains serve as model systems for studying the formation of lipid rafts in complex biological membranes. In the talk, I will present a new lattice model of a binary mixture of saturated DPPC lipids and cholesterol, which is the simplest model system exhibiting Lo domains in the sea of liquid-disordered (Ld) matrix. Simulations of mixtures of thousands of lipids and cholesterol molecules on time scales of hundreds of microseconds reveal a phase diagram that is in complete agreement with the well-established phase diagram of this mixture. The simulations provide important information on the morphologies and lifetime of the Lo domains which are not available by more detailed computational approaches. Strikingly, the lattice simulation also reproduces local structures that have been observed in atomistic simulations. Specifically, we find that the Lo domains are highly heterogeneous and consist of gel-like hexagonally packed clusters of ordered DPPC chains, surrounded by cholesterol-rich regions at the domain boundaries. The simulation results are explained by a new thermodynamic mechanism that considers the disparity between the packing interactions of ordered lipid chains with cholesterol and each other.