



The University of Western Ontario

Faculty of Science

Department of Applied Mathematics

APPLIED MATHEMATICS COLLOQUIUM

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The Wonderful Cholesterol and its role in Cell Membranes and Lipoproteins

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Abstract:

Cholesterol is exceptional in many ways. This seemingly modest molecule plays a crucial role in cells, affecting a variety of cell membrane properties such as their mechanical stability, lateral diffusion, permeability, binding of solutes, and the functions of membrane proteins. The present understanding of the role of cholesterol in membranes is captured by the lipid raft model proposed by Simons and Ikonen in 1997 (*Nature* vol. XX, XXX). Recent evidence highlights the fact that various membrane proteins function in conjunction with the ordered membrane domains (rafts) enriched in cholesterol, stressing the importance of this sterol.

In the meantime, while cholesterol is crucial for health, excessive amounts of cholesterol are also problematic. Low density lipoprotein (LDL) particles ("bad" cholesterol) are known as the key players in the formation of atherosclerotic lesions in the arterial. High density lipoprotein (HDL, "good" cholesterol) entities, on the other hand, are believed to remove excess cholesterol from plaque in arteries, thus slowing the buildup.

The intriguing theme connecting rafts and lipoproteins is the lack of understanding regarding their structures and functions on atomistic scales. Here we discuss recent progress in this field, providing examples of extensive simulations that have been able to shed light on the structure and dynamics of lipid rafts, and provide insight into the structures of the complex lipoprotein particles.