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Neutrons and Model Membranes: Moving Towards Complexity

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Current research in membrane protein biophysics highlights the emerging role of lipids in shaping membrane protein function. Cells and organisms have developed sophisticated mechanisms for controlling the lipid composition and many diseases are related to the failure of these mechanisms. One of the recent advances in the field is the discovery of the existence of coexisting micro-domains within a single membrane, important for regulating some signaling pathways. Many important properties of these domains remain poorly characterized.

The characterization and analysis of bio-interfaces represent a challenge.

Performing measurements on these few nanometer thick, soft, visco-elastic and dynamic systems is close to the limits of the available tools and methods.

Neutron scattering techniques including small angle scattering, diffraction, reflectometry as well as inelastic methods are rapidly developing for these studies and are attracting an increasing number of biologists and biophysicists at large facilities.

The talk will review some recent progress in the field and provide perspectives for future developments. It aims at highlighting neutron reflectometry as a versatile method to tackle questions dealing with the understanding and function of biomembranes and their components.

Since many biological processes occur at interfaces, the possibility of using neutron reflection to study structural and kinetic aspects of model as well as real biological systems is of considerable interest. The most effective use of neutron reflection involves extensive deuterium substitution and this is becoming more and more an available option in biological systems due to the creation of protein deuteration laboratories.

The study of asymmetric bilayers and flip-flop phenomena [1], of the inclusion of raft forming molecules [2] and the use of lipids from natural yeast extracts [3] will be highlighted.

[1] Gerelli, Y. et al. *Langmuir* 2013, 29 (41) 12762-12769 & Gerelli, Y. et al. *Langmuir*, 2012, 28 (45), 15922-15928

[2] Rondelli, V. et al. *Biochimica et Biophysica Acta* 2012, 1818, 2860-2867

[3] Gerelli Y. et al., *Acta Crystallographica Section D* (2014); 70(12):3167 & de Ghellinck, A. et al. *PLoS ONE* 01/2014; 9(4):e92999

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