# 第 234 回

# 物質科学セミナー

## 題名：リン脂質膜の弾性的性質と熱揺らぎ

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**日時：2016 年 6 月 20 日（月） 16:30 – 18:00**

**場所：総合科学部　K202**

## 講演要旨：

Lipid membranes undergo an array of conformational and dynamic transitions, ranging from individual lipid motions to undulations of micron-sized patches of the membrane. However, the dynamics at intermediate length scales are largely unexplored due to experimental challenges in accessing the appropriate length and time scales. Here we use neutron spin echo spectroscoty (NSE) to provide unique insigthts into these elusive dynamics and measure bending and thickness fluctuations in model lipid bilayers. These thermally induced fluctuations lead estimation of membrane viscoelastic properties. Bending fluctuations give us bending rigidity, $\kappa$, of bilayers following single membrane undulation model [1], typically on the order of 10 $k_{\mathrm{B}}T$ in the fluid phase and order 100 $k_{\mathrm{B}}T$ in the gel phase [2]. The time scale of thickness fluctuations is estimated on the order of 100 ns with the fractional change of the bilayer thickness of about 10 % [3]. Thickness fluctuation amplitude relates to the bilayer area compressibility modulus, $K_{\mathrm{A}}$, assuming volume conservation of the system [4], while the time scale of the motion determines the membrane viscosity, $\mu$ [5]. Upon mixing two lipid molecules who have hydrocarbon tail length mismatch show a larger fractional change of the bilayer thickness as large as 20 % [6]. Calculation of these viscoelastic parameters $\kappa, K_{\mathrm{A}}$ and $\mu$ for the hydrophobic mismatched bilayers yields more flexible, more compressible but less viscous bilayer conditions. The present methodology combining small-angle x-ray and neutron scattering (SAXS and SANS) with NSE to measure bilayer structure and dynamics gives new avenue to investigate physical properties of this important class of materials.

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[3] A.C. Woodka, P.D. Butler, L. Porcar, B. Farago and M. Nagao, Phys. Rev. Lett., 109, 058102 (2012).
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[5] R.J. Bingham, S.W. Smye, and P.D. Olmsted, Europhys. Lett., 111, 18004 (2015).
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5 研究科共同セミナーの認定科目です

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