Bilayers at the ILL

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Effects of alcohol addition on a fatty acid membrane

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Given the probable extremely contrasted environmental conditions at the origins of life (high temperature, pressure and pH), the origin and nature of the first cell membranes is still an open question. Due to complex organic carbon limitations, the first membranes were most likely composed of simpler, single chain fatty acids [1], which raises questions as how they could withstand the very variable and extreme surrounding environment [2].
Our current project considers two possible architectures for protocell membranes: a) a bilayer made of decanoic "capric" acid; b) a mixture of capric acid with a fatty alcohol of equal chain length, decanol.
Several complementary techniques have been employed to characterize these model single-chain amphiphiles vesicles. Among them, Static / Dynamic Light Scattering allowed to observe vesicle appearance, characteristics and time stability. Differential Scanning Calorimetry was employed to detect the membrane phase transitions and stability with temperature. Solid State NMR spectroscopy allowed assessing the bilayer rigidity for both models at different temperatures. Small Angle Neutron Scattering allowed to quantify the vesicle amount, size, lamellarity and membrane thickness.
The results allow defining the substantial role of the fatty alcohol presence in modifying the membrane characteristics and behavior at both ambient and high temperatures; they will serve as a basis to study the combined high temperature – high hydrostatic pressure effects, as these are the mandatory physical parameters to test the validity of the protomembrane model architectures.
The latest results, obtained with the above-mentioned techniques, will be presented.

References

[1] P.A. Monnard, D.W. Deamer, Met. Enzym. (2003) 372:133-51.
[2] K. Morigaki, P. Walde, Curr. Opin. Coll. Inter. Sci (2007) 75:80.

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