Experimental report

08/10/2016

Proposal: **8-04-755**

Council: 4/2015

Title: Self-organisation of RNA in lipid multilayers

Research area: Biology

This proposal is a new proposal

Main proposer: **Marie Christine MAUREL**

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Samples: Yeast total lipids with AMP

Instrument	Requested days	Allocated days	From	To
IN16B	4	4	16/10/2015	20/10/2015
IN5	3	3	26/10/2015	29/10/2015

Abstract:

RNA displays a diversity of properties, which are now being developed for medical applications. A significant limitation to progress is that RNA can only be synthesized in small quantities using specific enzymes and costly substrates. A recent discovery is that guided polymerization in an anhydrous lipid environment can promote a non-enzymatic reaction in which oligomers of single stranded ribonucleic acids are synthesized from ordinary mononucleotides such as AMP. The observation is also highly relevant for origin of Life studies of how nucleic acids first assembled and then were incorporated into the earliest forms of cellular life. The presence of multilamellar phospholipids as an organizing matrix markedly enhanced the yield of polymeric products, presumably because the matrix serves to concentrate and organize the mononucleotides as well as allowing a degree of diffusional mobility required for extensive polymerization. The proposal is to characterize AMP/phospholipid multilamellar dynamics on IN5 and IN16B with the aim of furthering our understanding of the RNA polymerization process. The work is part of Laura Da Silva's PhD.

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Abstract of paper submitted to *Life*. We used neutron scattering to investigate 5'-adenosine monophosphate (AMP) molecules captured in a multilamellar phospholipid matrix composed of a mixture of phospholipids extracted from *Pichia pastoris* cells to study the formation of RNA-like polymers. The structure of the matrix/AMP complexes was determined with subnanometer resolution from membrane diffraction measurements on D16. Elastic and quasielastic neutron scattering experiments (ENS, QENS) on IN16B and IN5 were employed to investigate the changes of dynamical properties of AMP induced by embedding the molecules within the lipid matrix. The use of different complementary instruments allowed to cover a wide time-scale domain, from ns to ps, of proton mean square fluctuations providing evidence of a well defined dependence of the AMP dynamics on the hydration level.