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The interaction of viral fusion peptides with model lipid membranes at high hydrostatic pressure

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When a virus enters a host cell, the insertion of viral fusion peptides (FPs) into the target membrane catalyzes the membrane fusion reaction. While fusion intermediates with high membrane curvature appear in this process, the exact mechanisms of the peptide/membrane interactions remain unclear up to now. We investigated the insertion mechanism of different FPs into model membranes in X-ray reflectivity measurements at the interface between monoolein/water mixtures and a silicon substrate. In addition, the bulk and interfacial structures were investigated with small angle X-ray scattering in transmission and in surface-sensitive grazing incidence. Monoolein/water mixtures have a very rich phase diagram, which can be tuned by pressure. Notably, the inverse bicontinuous cubic phases exhibit structural analogy to the hemifusion intermediates. Previous studies demonstrated the effect of FPs on the pressure-dependent phase boundaries [1].
We found that pressurization triggers formation of ordered lamellar monoolein multilayers at the hydrophilic surface even in a pressure range where the bulk material is in the cubic phase. We resolved the vertical membrane structure of these multilayers and monitored closely the penetration of FPs into the membrane.
Experiments were performed in a custom-made high hydrostatic pressure cell [2] at beamlines ID31 of the ESRF and BL9 of DELTA.

[1] A. Levin et al, J Phys Chem B 121 8492-8502, 2017
[2] F.J. Wirkert et al, J. Synchr. Radiat. 21 76-81, 2014

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