2020 HGF – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

Title of the project:

Influence of osmolytes on lipid model membranes

Helmholtz Centre, division/group:

Deutsches Elektronen-Synchrotron DESY

Project leader:

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Description of the project (max. 1 page)**:**

Influence of osmolytes on lipid model membranes

In this project we intend to study the influence of natural osmolytes on the fluidity and stability of lipid model membranes. Osmolytes are compounds affecting osmosis. They are soluble in the solution within a cell, or in the surrounding fluid, e.g. as plasma osmolytes. They play a role in maintaining cell volume and fluid balance. In this way we expect to determine whether the dominant interaction of these solutes takes place on the lipids, or more indirectly by affecting the properties of aqueous environment. We aim to determine the number of phases formed in each system, their transition temperatures and reversibility. SAXS/WAXS can identify these structures and provide the dimensions of their lattices.
Lipid bilayers can display a wide range of morphologies and are simple models for the cell membrane, that not only defines the cell limits but also provides a matrix for anchoring a variety of substances, *e.g.* membrane proteins, glycolipids, *etc*. Recently, we have studied the structural effects of TMAO and Urea, in order to investigate their contribution to morphologies[1]. Summarizing, we can say that the insertion of these s additives alters the temperature of phase transitions comparative to pure lipids and may induce the formation

of cubic phases at low temperatures, e.g. 30°C, which corresponds to an increase of the lipid matrix surface curvature.
We intend to determine how these organic solutes affect the lipid membrane and determine their contribution to fluidity, or curvature, induced on them. Moreover, the scattering patterns of cubic phases were observed despite their low resolution. In some cases micellar cubic phases were observed.
We notice the absence of SAXS-based data available in the literature for the structural effect of such solutes. Therefore we aim to investigate these systems in detail, hoping to determine the structure and precise lattice parameter of such phases.
We plan to investigate the structural influence of different osmolytes, e.g. betaine, taurine, *etc.* and their mixtures in membranes of lipids having different polarities in their head groups, *e.g*. POPC and POPE, when fully hydrated. Moreover we shall change the solute composition, keeping concentrations physiologically relevant.

[1]. Valerio J., Bernstorff S., Funari S. S., *Eur. Phar. J*. 2017,**64**,1.

Description of existing or sought Chinese collaboration partner institute (max. half page)**:**

Required qualification of the post-doc:

- PhD in Physics or Chemistry
- Experience with X-rays and simple chemistry laboratory procedures
- Additional skills in basic software programing, able to work with SAXS, FTIR and ability to both work independently and interacting constructively in a group
- Language requirement: English read and writing is essential