Thesis Project Offer

Joint Research and Education Programme “Palestinian-German Science Bridge PGSB”
Forschungszentrum Jülich GmbH & Palestine Academy for Science and Technology

Thesis type*
☐ BSc ☐ MSc ☒ PhD Intended starting date (approx.): 2020

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Project description*
Protein diffusion in lipid-bilayer membranes is determined by the protein, but also by the shape and the lipid structure the membrane. Therefore, theoretical predictions of protein diffusion do not only involve diffusion on a curved surface, but also a potential energy landscape for the protein in different locations on the membrane. This project has potential applications for protein crystallisation in triply periodic lipidic cubic phases, where a control over the aggregation dynamics may lead to slower aggregation and therefore better crystallisation. At low protein concentrations, the equilibrium distribution of proteins acts as sensor for the local energy and can be used to compare theoretical predictions with experimental results. At high protein concentrations, locally different elastic parameters due to aggregation can induce structural changes of the lipidic phase, which can lead for example to a transition of the lipid arrangement from a sponge-like phase to a lamellar phase.

In a first step, the student will calculate energies of proteins in different locations on a curved lipid bilayer membrane using a continuum membrane model. Here, the deformation of an elastic protein because of the curvature of the surrounding membrane as well as the deformation of the membrane by the protein have to be taken into account. In a second step, the student will use lipid-scale molecular modelling to include the lipid substructure of the membrane for the energy calculations.

Date* Signature*
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