

Project 4.1 Mesoscale simulations of bio-membrane adhesion (theoretical)

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Unit: ON5

www: <https://sites.google.com/view/bartosz-rozycki-biomembranes/research>

Background:

Cell membranes contain fluctuating nanoscale molecular clusters, or domains, enriched in sphingolipids, cholesterol, and proteins. These nanodomains are commonly termed lipid rafts. They can be stabilized and made to coalesce, forming platforms that function in membrane signaling and trafficking. The physical mechanisms that cause the stabilization and coalescence of lipid rafts are a subject of intense research.

Aim:

We will investigate how membrane adhesion affects the distribution of lipid rafts in adhering membranes. We will also study the interplay between the membrane adhesion and the aggregation of raft-associated membrane receptors. Understanding these processes will be particularly relevant in the context of transmembrane signaling because receptor aggregation is a ubiquitous process triggering intracellular signals.

We will use Monte Carlo simulations and mean-field calculations within a mesoscale model of membrane adhesion. This project will be carried out in collaboration with researchers at Nanjing University, China.

Requirements:

- MSc in physics or an equivalent degree that qualifies one for PhD studies in physics in the country of issue,
- knowledge of classical statistical mechanics,
- interest in molecular biophysics,
- communicativeness and good command of spoken and written English,
- diligence at work and consistency in achieving results,
- programming skills (including scripting languages) and knowledge the Linux environment,
- experience in Monte Carlo simulations will be considered an asset.

Funding:

Scholarship: grant funding of 5000 PLN per month, before subtracting obligatory employer and employee social security contributions (~15%), for 30 months. Afterwards standard Polish PhD scholarship (about 3240 PLN/month net) in months 31-48.

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