

# INTERACTIONS IN THE MODEL MEMBRANES MIMICKING PRECLINICAL CONFORMATIONAL DISEASES

Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**

Mode of study:

Duration: **4 years**

Availability of free education: **yes**

Price: **375 000 RUB**

Programme webpage at the university website:

<https://eng.mipt.ru/programs/interactions-in-the-model-membranes-mimicking-preclinical-conformational-diseases/>

Programme curator: **Denis Ustyuzhaninov**

Tel.: **+7 (498) 713 91 70**

E-mail: [interadmission@phystech.edu](mailto:interadmission@phystech.edu)

## Entry requirements:

- Master's degree / equivalent in a related field
- B2 level of English
- Good track record of publications related to the topic of the intended research
- Strong research proposal 1,500 - 3,500 words

## Research supervisor:

[Norbert Kučerka](#)

PhD, DSc, Deputy Director for Science Frank Laboratory  
of Neutron Physics Joint Institute for Nuclear Research

## Supervisor's research interests:

- Lipid membrane structure and dynamics.
- Role of hydration in model and biological membranes.
- Effects of membrane surrounding ions on its properties.
- Interactions of Ab-peptides with lipid membranes.
- Incorporation of amyloid-beta peptides into the membrane.
- Neutron and X-ray scattering techniques.
- Densitometry, calorimetry, fluorescence, optical methods.

## Research highlights:

Closer look at modern problems of fluid membranes

Research approaches utilize unique on-site facilities:

- Neutron scattering on pulsed neutron reactor.
  - Raman spectroscopy on multimodal optical platform.
  - MD simulations on computer cluster. Research project is supported by Russian Science Foundation
- Collaboration with Slovakia, Czechia, Germany, Canada.

## Supervisor's specific requirements:

- Physical chemistry.
- Work in chemical laboratory.
- Biophysical thermodynamics.
- Experimental methods for membrane biophysics: some of scattering methods, optical methods, calorimetry.

**Main publications:**

- Ivankov O.,..., Kučerka N.: Interactions in the model membranes mimicking preclinical conformational diseases; *Advances in Biomembranes and Lipid Self-Assembly*; Elsevier (2020).
- Kučerka N., Uhríková D.: Biophysical perspectives of lipid membranes through the optics of neutron and X-ray scattering; *Biological Membranes*; deGruyter (2019).
- Kučerka N., Gallová J., Uhríková D.: The Membrane Structure and Function Affected by Water; *Chemistry and Physics of Lipids* 221 (2019) 140-144.
- Kučerka N., ..., Uhríková D.: Calcium and zinc differentially affect the structure of lipid membranes; *Langmuir* 33 (2017) 3134-3141.
- Kučerka N., ..., Katsaras J.: Structural Significance of Lipid Diversity as Studied by Small Angle Neutron and X-ray Scattering; *Membranes* 5/3 (2015) 454-472.
- Drolle E., Kučerka N., ..., Leonenko Z.: Effect of melatonin and cholesterol on the structure of DOPC and DPPC membranes; *BBA* 1828 (2013) 2247-2254.

**Specializations within this programme**