J.Heyrovský Institute of Physical Chemistry

From atoms to pathways: elucidating the physicochemical principles of enzyme organization in cells

10 am, Thursday, January 27th 2022, J.Heyrovský Institute

The form of the meeting will be specified

Mgr. Štěpán Timr,Ph.D.

Štěpán Timr is an Associate Scientist at the J. Heyrovský Institute of Physical Chemistry, CAS. He focuses on multi-scale computational modeling of biomolecules in conditions approaching those in living cells. His simulations allowed him to characterize the effects of transient intermolecular interactions on protein stability and diffusion, describe the unfolding of the disease-related SOD1 protein in crowded conditions, and inquire into protein dynamics near the temperature of cell death. He obtained a Ph.D. in Physics from Charles University in 2017.

Traditionally, metabolic processes have been viewed as a disordered mixture of freely diffusing enzymes and substrates inside the living cell. However, growing experimental evidence shows that consecutive enzymes of a metabolic pathway often co-localize into dynamic assemblies, governed by transient interactions. While such assemblies may play a key role in metabolic regulation and control, the mechanisms underlying their formation and function remain unclear.

In this presentation, I will first highlight some of my achievements in simulating crowded biomolecular systems. I will then outline my research program aimed at creating a multi-scale simulation scheme for the description of dynamic enzyme assemblies. The resulting scheme, ranging from an atomistic to a mesoscopic level, will link interactions and conformations in an enzyme assembly to the large-scale control of metabolic flux. The research will open up new ways for the rational design of synthetic metabolic networks and suggest new possibilities of disease treatment.