Open Ph.D. projects

1.

Announcer: László Zimányi

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology, University of Szeged, Faculty of Science and Informatics, Doctoral School of Physics, University of Szeged, Doctoral School of Multidisciplinary Medicine

Title of the research topic: Transmembrane electron transfer, the basis for the biological activity of cytochrome b561 proteins

Description of the research topic: Ascorbate, one of the most important components of the redox regulation of cells serves as the electron source for the cytochrome b561 (CYB561) proteins, containing two heme cofactors and performing transmembrane electron transfer. CYB561-s are abundant in plants and animals as well, found in various organs and cells. They participate in neurotransmitter synthesis, in the Fe(III) reduction necessary before iron uptake, and certain CYB561-s in tumor suppression. Homology modelling performed based on two available atomic resolution X-ray crystallographic studies may provide structural information on other members of the protein family. The applicant will study the mechanism of the electron transfer (and coupled proton displacement) and ligand binding, as well as the role of the conserved amino acids, primarily by in silico investigations. He/she will interpret and explain available experimental results based on molecular modelling, molecular dynamics and electron transfer calculations.

2.

Announcer: Attila Gergely Végh

Doctoral School: University of Szeged, Faculty of Science and Informatics, Doctoral School of Biology, University of Szeged, Doctoral School of Multidisciplinary Medicine

Title of the research topic: Nano-scale dynamics of cellular mechanobiology

Description of the research topic: The most life-threatening aspect of cancer is metastasis; roughly 90% of cancer patient mortality is due to metastasis. It is still not understood why some primary tumors metastasize and thus have a worse outcome compared to others that do not metastasize. In most cases, dissemination of cancer cells relies on lymphogenous or hematogenous routes. The interface between blood flow and surrounding tissue, built by endothelial cells, is the first defense line encountered by metastatic cancer cells. The key step in this process is the establishment of firm adhesion between the blood-traveling cell and the endothelial layer.

Our research is focused on nanomechanical characteristics which are essential for metastatic cancer cells to be able to migrate through the tight layer of endothelial cells. In our laboratory, we perform morphological and nano-mechanical investigation of living cells which are enrolled in the above mentioned process, with an atomic force microscope and side view optical microscope. Our investigations are based on specific nanomechanical techniques such as high resolution 3D topography, stiffness maps and the whole arsenal of single-cell force spectroscopy.

The collected data during this research proposal relying on the wide spectrum of intra (stiffness, viscosity etc.) and intercellular (adhesion force, detachment work, tether formation dynamics etc.) parameters would lead to better understanding of metastasis formation, pointing towards potential pharmacological or therapeutic possibilities.