

## Ph.D. projects in progress

1.

**Mentor:** Csaba Tömböly

**Doctoral school:** Faculty of Medicine, University of Szeged, Theoretical Medicine Doctoral School

**Ph.D. student:** Judit Darusi

**Title of the research topic:** Preparation of lipidated interleukins for targeted cell membrane delivery

**Description of the research topic:** Targeted delivery of proteins without genetic methods is of great importance both in biotechnology and in medicine. Isolated GPI-anchored proteins can be transferred to the plasma membrane of diverse host cells with preserving the original protein function. However, their wide-spread application is limited by the complex structure of the glycolipid moiety that is chemically hardly accessible and that can have unknown biological functions. The responsibility of the candidate is to develop novel lipid amphiphils that can be applied as structurally simplified protein membrane anchor moieties. To achieve this goal novel bioorthogonal methods will be explored for protein lipidation, and inclusion complexes and exosomes will be studied as delivery vectors of the lipidated proteins. In pilot studies the effect of lipid modification on the immune activity of interleukins will be investigated.

2.

**Mentor:** Attila Borics

**Doctoral school:** Faculty of Medicine, University of Szeged, Theoretical Medicine Doctoral School

**Ph.D. student:** Argha Mitra

**Title of the research topic:** Investigation of the activation mechanism of G protein-coupled receptors using state-of-the-art molecular modeling tools and procedures.

**Description of the research topic:** The focus of this research project is the deeper, atomic-level investigation of the structural mechanism of activation of G protein-coupled receptors (GPCRs). Deeper understanding of such mechanism could provide basis for the successful treatment of numerous pathological conditions with the use of exogenous agents of natural or artificial origin. Our studies are aimed at the interactions between GPCRs and their ligands and the effect of such interactions on the electrostatic balance of the protein complex and its role in the process of signaling, revealing a general mechanism of this receptor family.

3.

**Mentor:** Attila Borics

**Doctoral school:** Faculty of Medicine, University of Szeged, Theoretical Medicine Doctoral School

**Ph.D. student:** Arijit Sarkar

**Title of the research topic:** Investigation of the effect of cell membrane composition and specific lipid-protein interactions on the activation mechanism of G protein-coupled receptors.

**Description of the research topic:** Our fundamental research interest, aiming at the structural mechanism of activation of G protein-coupled transmembrane receptors (GPCRs), is extended to investigate the effect of lipid membrane bilayer composition on the interactions between signaling molecules and the overall process of signaling. Besides the applications and study of model membrane systems with various compositions, our investigations rely on most recent and accurate lipidomic data.