

## Ph.D. projects in progress

1.

**Mentor:** Péter Vilmos

**Doctoral school:** Doctoral School of Multidisciplinary Medical Science, University of Szeged

**Ph.D. student:** Zoltán Kovács

**Title of the research topic:** Investigation of the nuclear transport and function of the actin-binding Moesin protein

**Description of the research topic:** Actin is one of the most abundant, multifunctional protein in every eukaryotic cell. One of the most important novel findings in the past decade is the discovery of actin and actin-binding proteins in the nucleus. Nuclear activities including transcription, editing and nuclear export of mRNAs, chromatin remodeling and DNA repair all depend on actin. It also became clear that there is a fine-tuned equilibrium between cytoplasmic and nuclear actin pools and that this balance is ensured by an export-import system dedicated to actin.

In the Laboratory of Drosophila Nuclear Actin Research of the Biological Research Centre we investigate the biological significance of this surprising nuclear localization in the case of actin and an actin-binding protein, Moesin. The candidate will participate in the investigation of the nuclear export and in the exploration of the nuclear function of Moesin. In the first phase of the work he/she will use fluorescent microscopy techniques to analyze the dynamics of the nuclear export of Moesin and the factors influencing the export process. Next, with the help of cultured cells and transgenic animals, the candidate will identify the exportin and the protein motif responsible for the nuclear export of Moesin. To uncover the nuclear functions of Moesin, the experiments will focus on the interaction between nuclear actin and Moesin.

2.

**Mentor:** Péter Vilmos

**Doctoral school:** Doctoral School of Multidisciplinary Medical Science, University of Szeged

**Ph.D. student:** Péter Borkúti

**Title of the research topic:** Investigation of the nuclear actin function

**Description of the research topic:** Actin is one of the most abundant, multifunctional protein in every eukaryotic cell. Actin itself as well as the numerous actin-binding proteins are major components of the cytoskeleton. Extensive research in the past decade has significantly broadened our view about the role actin plays in the life of the cell and added novel aspects to actin research. One of these new aspects is the discovery of the existence of nuclear actin

which became evident only recently. Nuclear activities including transcriptional activation in the case of all three RNA polymerases, editing and nuclear export of mRNAs, and chromatin remodeling all depend on actin. It also became clear that there is a fine-tuned equilibrium between cytoplasmic and nuclear actin pools and that this balance is ensured by an export-import system dedicated to actin. After over half a century of research on conventional actin and its organizing partners in the cytoplasm, it was also an unexpected finding that the nucleus contains more than 30 actin-binding proteins and new classes of actin-related proteins which are not able to form filaments but had evolved nuclear-specific functions.

In the Laboratory of Drosophila Nuclear Actin Research of the Biological Research Centre we investigate the biological significance of this surprising nuclear localization in the case of actin and an actin-binding protein, Moesin. The candidate will participate in the exploration of the nuclear functions of actin. In the first phase of the work he/she will modify the Actin5C gene of Drosophila in different ways to examine the biological significance of the nuclear localization of actin. Next, the candidate will confirm the nuclear functions and the collaborations with interacting partners, such as Moesin, of nuclear actin, by using cell biology techniques, genetic and biochemical methods both in cultured cells and transgenic animals.