Insects is the largest group of animals. They are capable of surviving in almost every environment from deserts of Africa, through grasslands of temperate zones to freezing permafrost of Arctic regions. The success is due to their impressive tolerance to environmental stresses, and resistance to low temperature is one of them. Neuroendocrine system and its compounds such as neuropeptides and biogenic amines play central role in the regulation of physiological and behavioural processes in insects, directly impacting temperature stress survival. It can be expected that in response to the cold stress, molecules responsible for osmoregulation such as CAPA, inotocin-like peptides, ion transport peptide, diuretic hormones and calcitonin will take part as well as substances related to the response to stress factors such as tachykinin-related peptides or peptides responsible for mobilization of reserve substances like adipokinetic hormones. Most of these molecules exert divers pleiotropic activities on different tissues and their actions inter-link between each other giving the physiological response required for survival of the organism. **Hence, the proposed project aims to evaluate the role of neuro-endocrine system in the response to low temperature stress and broaden the knowledge about cryoprotective mechanisms in model beetle species *Tenebrio molitor* L.** The following hypotheses have been adopted in the project:

- Cold stress induces changes in neuropeptidome of *T. molitor*; modifies the level of expression mainly of diuretic, antidiuretic and metabolic neuropeptides
- Neuropeptides take part in response to cold stress
- Neuropeptides during cold stress modulate quantitatively and qualitatively metabolome

In this project we plan to evaluate the role of neuro-endocrine system in responses to low temperature (0°C) stress of model beetle species – *Tenebrio molitor* L. *T. molitor* (Tenebrionidae, Coleoptera), is a freeze-susceptible species that does not survive cooling to below the supercooling point. Since for example the SCP of *T. molitor* is highly variable, ranging from −1.5 to −24.3 °C, in the first step we will determine the basic parameters of the response to cold stress (supercooling point [SCP], chill-coma recovery time [CCR], the lowest lethal temperature [LLT]). After determining the above mentioned parameters we will perform microsurgical isolation of central nervous system [CNS] (brain and ventral nerve cord) and asses the changes in transcriptome **(transcriptomics)** of each part of CNS

We assume that most changes will be seen in diuretic, antidiuretic and metabolic neurohormones (e.g. CAPA, kinins, ILPs and AKH). Thus, after the transcriptomic analysis chosen neuropeptides will be injected into the beetles and again the basic parameters of the response to cold stress will be measured to asses if neuropeptides affect these.

Realization of proposed project will allow to determine how neuro-endocrine if so controls the response to cold stress in beetles. Obtained results will allow also to better understand cryoprotective mechanisms in insects as such. The knowledge obtained in this project about the role of neuro-endocrine system may be used in future to develop new ways to fight with invasive species due to inevitable climate changes.