Seasonality refers to periodic, regular, and predictable changes occurring over a year and caused by the tilt of the Earth's axis. Animals respond to those changes by adjusting their phenotype. Winter is the most demanding period throughout the year, and small mammals living in Boreal and Temperate Zones respond to shortening photoperiod (day length) by the development of many winter traits: reduced body mass, cessation of reproduction or moulting to better insulated, white fur. Although these traits decrease energy expenditure and allow to survive in adverse environment, not all individuals in the population respond to changes in photoperiod. In a population of many species, we observe individuals of various phenotypes: responders (with all winter traits), partial responders (with some winter traits) and nonresponders (with summer phenotype). These species present polymorphism of winter phenotype. The best-known example of this phenomenon is winter coat colour polymorphism, observed in hares, weasels or Arctic foxes.

Although the mechanism of seasonal response was thoroughly studied, the background of winter phenotype polymorphism is not known. Based on literature data and our preliminary research, we propose two different scenarios explaining the mechanism of the development of winter phenotype. We propose that polymorphism of winter phenotype develops as a consequence of the differences in the functioning of the seasonal clock, either 1) upstream or 2) downstream of the thyroid hormone system in the hypothalamus. To test these hypotheses, we will compare the expression of genes encoding primary agents regulating seasonal response in responding, nonresponding and partial responding individuals. We will use Siberian hamster *Phodopus sungorus* as a model species for studies on seasonality and polymorphism.

Global climate change alters many aspects of seasonal response. Since polymorphic species seem to tolerate climate changes better than monomorphic species, polymorphism of winter phenotype becomes more frequent. This project will allow us to better understand the mechanism of the development of polymorphism of winter phenotype and seasonality itself.