Climate change is the major challenge for the world economy, especially for the agricultural sector where climate conditions strongly and directly influence crop yields. Because of the global warming it may seem that winter survival of crops will lose importance. But it is a wrong assumption – probably the only thing that will change will be the most important factors influencing overwintering of plants locally. The risk of winter damage to the plants may not decrease because of complex interactions among different environmental factors. For example, the frequency, degree and length of extreme winter warming events may increase, leading to loss of freezing tolerance that the plants gained during autumn. Such process is called "active" de-hardening or 'active" deacclimation, as opposed to "passive" de-hardening (deacclimation), which is independent of the environmental conditions and may be related both to vegetative/generative transition and to the decrease of organic compounds that were gathered by the plant before winter. During three last winters (2013/2014, 2014/2015 and 2015/2016) several day long warm spells with temperatures above 10ºC occurred in Poland. Subsequent freezing temperatures, mild, in fact, were extremely harmful for some plants.

Winter barley is sown on a relatively small area in Poland because it has the lowest winter hardiness among all of the winter cereal grasses grown in our country. However, when winter is mild, winter barley always yields better than spring barley, which explains growing interest of the beer industry in winter cultivars. Yield losses caused by winter damages are big in winter barley, even during such mild and warm winter, as the last one in Poland (winter of 2015/2016). Low tolerance to "active" deacclimation may be the reason for this situation. There is not much information available on the mechanisms of the tolerance to "active" de-hardening in agricultural plants, including the genes involved. The aim of this study is the identification of genes related to tolerance to 'active" deacclimation in winter barley. I assume that in winter barley, different genes (at least partially) are responsible for freezing tolerance and tolerance to deacclimation.

This project aims to check the variability in tolerance to "active' deacclimation among Polish winter barley lines and European cultivars. This purpose will be reached by measuring many different physiological traits of barley, that are involved in freezing tolerance in cold-acclimated and deacclimated plants. The most and the least tolerant cultivars will be chosen. The next step will be to explain the reasons for these differences. Molecular analysis will be performed on genetic material of barley in order to discover what genes are specific for the process of "active" deacclimation and tolerance to this phenomenon. In the last stage of the research the data on the genes involved in the mechanism of tolerance to "active" cold deacclimation obtained in the project will be compared with the data on the genes involved in the mechanism of freezing tolerance available in research articles.

There is a common opinion that all components of winter hardiness share the same or similar genetic basis, because they all affect plant survival during winter. This study aims to show that different genes are responsible for tolerance to deacclimation and for freezing tolerance, what is more, that "active" and "passive" deacclimation differ in genetic background. This will be a novel information itself, not only for scientific community, but also for plant breeders who may use the results of this project for breeding plants that will be more winter hardy under future climate conditions.