

Sturgeons belongs to the oldest fish, known as "living fossils". There is a significant difference in the reproductive biology between sturgeons and commonly occurred teleost fish. The distinguishing feature of the sturgeon spermatozoa is the presence of functional acrosome, which which undergoes acrosomal reaction. In mammals, the molecular mechanism of acrosomal reaction is well characterized. During this process the hydrolytic enzymes, such as acrosin, are released from the acrosome, leading to the sperm penetration of the zona pellucida and consequently allows to fertilization of oocytes. Interestingly, the oocytes of sturgeons are perforated by numerous micropyles, whereas their spermatozoa possess a functional acrosome containing the acrosomal enzymes. Thus, the process of acrosomal reactions in sturgeons is still unclear. The uniqueness of the sturgeon gametes may reflect the transient state of their features in the evolution process. Furthermore, the microscopic examinations of acrosomal reaction showed changes in the in the sturgeon's spermatozoa, including the acrosome structures and formation of the specific filament on the apical region of the sperm head. However, there is a lack of studies describing the mechanisms underlying these changes. Therefore, the comprehensive analysis at protein level is essential for better understanding the process of acrosomal reaction and it's possible alternations during cryopreservation.

The long-term objective of this project is to obtain a new and original knowledge regarding molecular mechanism during process of acrosome reaction in the sperm of the Siberian sturgeon and understanding the mechanisms responsible for changes in the acrosome during cryopreservation. The first aim of this project is to characterize the Siberian sturgeon seminal plasma proteome using a novel proteomic methods, in order to understand the role of seminal plasma in the prevention of premature activation of acrosomal enzymes. The second task of this study is focused on detailed analysis of sperm proteome changes during the acrosomal reaction, evaluation of the protein redox status, assessment of their phosphorylation to predict the molecules involved in acrosomal reaction. The third aim of this project includes proteomic characterization of egg envelope, egg water and identification of specific proteins inducing acrosome reaction. Furthermore, the sperm proteome changes during the semen cryopreservation will be evaluated. Additionally, comprehensive analysis of sturgeon semen (sperm motility and viability, oxidative stress, acrosome status) will be performed.

The proposed studies are the first to unravel the molecular mechanisms underlying the acrosomal reaction and mechanisms of cryoinjuries in the acrosome structure. Obtained results within the framework of the project should significantly contribute to extend the knowledge on the control of the acrosomal reaction in physiological conditions as during cryopreservation. The obtained results can also be important for further experiments of applied science to improve the methods of long-term storage, in terms of controlling the integrity of the acrosome and premature acrosome reaction.