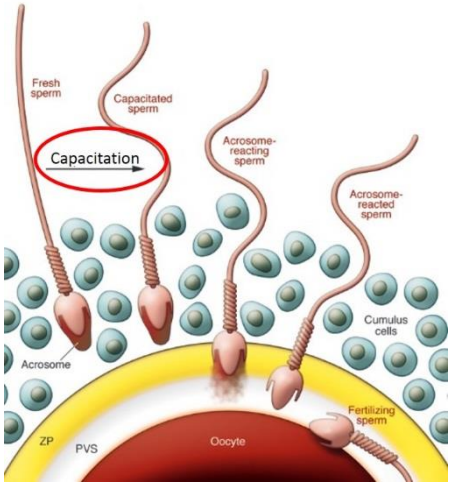
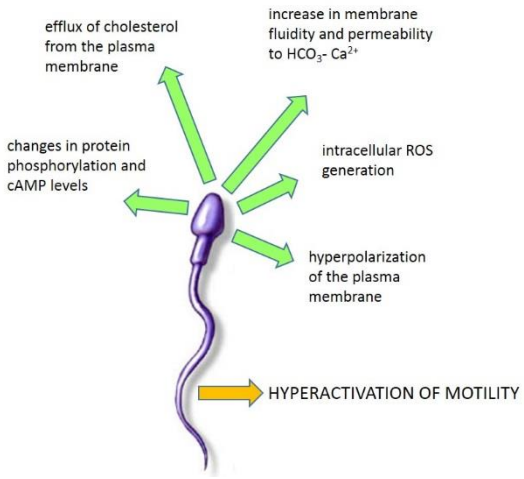
DESCRIPTION FOR THE GENERAL PUBLIC

REGULATION OF BULL SPERM CAPACITATION BY REDOX MODIFICATIONS OF PROTEINS

Freshly ejaculated mammalian spermatozoa are not capable to fertilize an egg and must undergo a series of biochemical and physiological modifications, collectively called capacitation, in the female reproductive tract to aquire fertilizing ability. The biochemical changes associated with the capacitation process include an efflux of cholesterol from the plasma membrane, increase in membrane fluidity and permeability to bicarbonate and calcium ions, intracellular reactive oxygen species (ROS) generation, hyperpolarization of the plasma membrane, changes in protein phosphorylation and cyclic adenosine monophosphate (cAMP) levels. Eventually, all of these changes lead to the acrosomal reaction, hyperactivation of motility and oocyte fertilization.





Capacitation disorders seems to be one of the most frequent causes of idiopathic (not related to sperm motility and morphology) causes of male infertility in humans. In recent years, growing interest concerning capacitation disorders in the context of male infertility has been observed which is reflected by significant increase in the number of studies describing the issue. Due to a pressing need of evaluation of capacitation capacity, indicators of sperm capacitation are currently taken into account in the diagnosis of male infertility, in addition to standard analyzes of motility and morphology. However, little is known about capacitation disorders in domestic animals. Therefore, further studies are prerequisite for better understanding of disturbances of capacitation in low-fertility bulls.

The long-term objective of this project is to obtain a new and original knowledge regarding molecular mechanisms accompanying the process of bull sperm capacitation, with particular emphasis on the redox mechanism of signal transduction. The first specific aim of the project is designed to evaluate quantitative changes of proteins and redox modifications to obtain detailed information on the proteome alterations during bull sperm capacitation. The second specific aim focuses at specific types of redox modification of proteins (S-nitrosylation, S-glutathionylation and carbonylation) during capacitation. The third specific aim relates to the dynamic changes of tyrosine phosphorylation of proteins involved in bull sperm capacitation. The last specific aim will be conducted depending on the results of experiments of specific aims 1, 2 and 3. The analyzes reflecting the most important changes due to capacitation will be selected and used to evaluate on sperm showing normal and decreased capacitation capacity.

To our knowledge, the proposed studies will be the first attempt to identify proteins involved in redox signaling during bull sperm capacitation and to explain the causes underlying the reduced capacitation capacity in bulls. Implementation of the project should lead to a significant extension of basic knowledge in the field of reproductive physiology of domestic animals. In the future, research may contribute to the development of new methods for the detection of capacitation and its disturbances.