Journal of Andrology, Vol. 25, No. 2, March/April 2004


# Interaction of PDC-109, the Major Secretory Protein From Bull Seminal Vesicles, With Bovine Sperm Membrane $Ca^{2+}$-ATPase

SILVIA SÁNCHEZ-LUENGO*, GERHARD AUMüLLER*, MARTIN ALBRECHT*, PARIMAL C. SEN‡, KARLHEINRICH RöHM† AND BEATE WILHELM*

*From the * Department of Anatomy and Cell Biology, Philipps-Universität, Marburg, Germany; ‡ Department of Biochemistry, Philipps-Universität, Marburg, Germany; and † Department of Chemistry, Bose-Institute, Calcutta, India.*

Correspondence to: Prof Dr Gerhard Aumüller, Department of Anatomy and Cell Biology, Robert-Koch-Str 8, D-35033 Marburg, Germany (e-mail: aumuelle{at} mailer.uni-marburg.de).



PDC-109 is the prevalent secretory protein from bovine seminal vesicles that binds to the midpiece of sperm once they pass the ampulla of the vas deferens during emission. Thereby, the protein changes biophysical membrane properties, eventually resulting in increased sperm motility. To elucidate the underlying biochemical mechanism, we have studied the ion-pumping activity ($Ca^{2+}$-ATPase) in membrane preparations of bovine spermatozoa following in vitro incubation with the protein and analyzed whether PDC-109 influences sperm motility. PDC-109 was purified to homogeneity from bull seminal vesicle extracts using a newly described method. The effect of PDC-109 on sperm motility was analyzed using the CASA-method. These experiments clearly demonstrated that PDC-109 significantly increases sperm motility. Calcium-pumping mechanisms were analyzed by monitoring the effect of PDC-109 on various parameters of enzyme activity of $Ca^{2+}$-ATPase in epididymal sperm plasma membranes and were compared with $Ca^{2+}$-ATPase activities from other organs and from epididymal sperm of different species, respectively. Specificity studies were performed using different $Ca^{2+}$-antagonists. Enzyme activities of both $Mg^{2+}$-dependent and $Mg^{2+}$-independent $Ca^{2+}$-ATPases increased in a dose-dependent manner following the addition of the PDC-109 (range 5–20 µg). Preincubation of PDC-109 at temperatures above 37°C and pHs ranging from below 6.5 and above 8.5 led to the loss of the stimulatory effect. An analysis of enzyme kinetics pointed to irreversible, cooperative interaction of PDC-109 with the enzyme. The effect was organ-specific, that is, restricted to sperm ATPases, but it was not species-specific, as it could be elicited also in rat sperm.

Key words: Seminal vesicles, bovine sperm, plasma membrane $Ca^{2+}$-ATPase