

Specific Order in the Appearance of Protein Tyrosine Phosphorylation Patterns Is Functionally Coordinated With Dog Sperm Hyperactivation and Capacitation

ANNA M. PETRUNKINA, KATRIN SIMON, ANNE-ROSE GÜNZEL-APEL AND
EDDA TÖPFER-PETERSEN

From the Institute for Reproductive Medicine, School of Veterinary Medicine Hannover, Hannover, Germany.

Correspondence to: Dr Anna M. Petrunkina, Institute for Reproductive Medicine, School of Veterinary Medicine Hannover, Bünteweg 15, 30559 Hannover, Germany (e-mail: anna.petrounki na{at}ti ho-hannover.de).

The aims of the present study were to characterize a slow capacitation system that records initial changes in the sperm membrane state, and, using a canine model, to order the specific protein tyrosine phosphorylation signaling in the sequence of capacitational events and to associate them with hyperactivated motility. Dog sperm washed through Percoll were incubated in complete bicarbonate Tyrode medium for 6 hours in 5% CO₂. Capacitation was evaluated using chlortetracycline staining. Tyrosine phosphorylation patterns were assessed by immunocytochemistry. Parallel to this, a computer-assisted motility analysis was performed. Significant changes in the percentage of capacitated and acrosome-reacted cells were first observed after 90 minutes, increasing in a linear manner during further incubation ($P < .05$). Changes in the percentage of capacitated cells were accompanied by motility changes. During incubation, a strictly sequential phosphorylation of sperm tail (midpiece, principal piece, and end piece) and head proteins was observed. According to an analysis of kinetics, phosphorylation of head proteins occurred after the tail became completely phosphorylated. Changes in head phosphorylation progressed at the same rates as capacitation and acrosome reaction. Sperm motility, curvilinear velocity, average path velocity, straight line velocity, and lateral head displacement were correlated positively or negatively with phosphorylation of midpiece or end piece proteins, respectively. The bicarbonate-stimulated increases in cyclic adenosine monophosphate levels and changes in protein phosphatase activity may be involved in the signaling system that controls membrane changes and motility in dog sperm. Phosphorylation kinetics of sperm proteins are potentially useful for diagnostic purposes to characterize the response of individual males to fertilizing conditions.

Key words: Kinetics, hyperactivation, membrane destabilization, sperm function, phosphorylation

This Article

- ▶ [Full Text](#)
- ▶ [Full Text \(PDF\)](#)
- ▶ [Alert me when this article is cited](#)
- ▶ [Alert me if a correction is posted](#)

Services

- ▶ [Similar articles in this journal](#)
- ▶ [Similar articles in PubMed](#)
- ▶ [Alert me to new issues of the journal](#)
- ▶ [Download to citation manager](#)

Citing Articles

- ▶ [Citing Articles via HighWire](#)
- ▶ [Citing Articles via Google Scholar](#)

Google Scholar

- ▶ [Articles by Petrunkina, A. M.](#)
- ▶ [Articles by Töpfer-Petersen, E.](#)
- ▶ [Search for Related Content](#)

PubMed

- ▶ [PubMed Citation](#)
- ▶ [Articles by Petrunkina, A. M.](#)
- ▶ [Articles by Töpfer-Petersen, E.](#)



Journal of ANDROLOGY

▶ HOME

A. A. Y. Khalil, A. M. Petrunkina, E. Sahin, D. Waberski, and E. Topfer-Petersen

Enhanced Binding of Sperm With Superior Volume Regulation to Oviductal Epithelium

J Androl, November 1, 2006; 27(6): 754 - 765.

[\[Abstract\]](#) [\[Full Text\]](#) [\[PDF\]](#)



BIOLOGY of REPRODUCTION

▶ HOME

J.L. Albarracin, J.M. Fernandez-Novell, J. Ballester, M.C. Rauch, A. Quintero-Moreno, A. Pena, T. Mogas, T. Rigau, A. Yanez, J.J. Guinovart, *et al.*

Gluconeogenesis-Linked Glycogen Metabolism Is Important in the Achievement of In Vitro Capacitation of Dog Spermatozoa in a Medium Without Glucose

Biol Reprod, November 1, 2004; 71(5): 1437 - 1445.

[\[Abstract\]](#) [\[Full Text\]](#) [\[PDF\]](#)



Reproduction

▶ HOME

S. Mededovic and L. R Fraser

Angiotensin II stimulates cAMP production and protein tyrosine phosphorylation in mouse spermatozoa

Reproduction, May 1, 2004; 127(5): 601 - 612.

[\[Abstract\]](#) [\[Full Text\]](#) [\[PDF\]](#)