

Journal of Andrology, Vol 20, Issue 1 126-134, Copyright © 1999 by The American Society of Andrology

JOURNAL ARTICLE

Evidence for the role of heterotrimeric guanine nucleotide-binding regulatory proteins in the regulation of the mouse sperm adenylyl cyclase by the egg's zona pellucida

P. Leclerc and G. S. Kopf

Center for Research on Reproduction and Women's Health, University of Pennsylvania School of Medicine, Philadelphia 19104-6080, USA.

Sperm acrosomal exocytosis is the result of a complex set of signal transduction pathways activated physiologically by the egg's extracellular matrix, the zona pellucida. In the mouse, the zona pellucida has been demonstrated to induce an increase in sperm intracellular pH, Ca²⁺, and cyclic adenosine monophosphate (cAMP) concentrations as well as to activate proteins of the G_i class (G_i; guanine nucleotide-binding regulatory proteins). We recently reported that the mouse zona pellucida could activate the adenylyl cyclase of mouse sperm. It is not known, however, whether zona pellucida stimulation of adenylyl cyclase activity is mediated through G proteins. In the present study, we demonstrate that the sperm membrane-bound adenylyl cyclase activity is stimulated by the G protein activators guanosine-5'- γ -thiotriphosphate (GTP γ S) and mastoparan in a concentration-dependent manner. The maximal adenylyl cyclase activity measured with these two G protein activators is similar to the stimulation observed with the zona pellucida, but the effect of GTP γ S is not additive or synergistic with the effects of mastoparan or the zona pellucida. Pertussis toxin treatment of sperm membranes inhibits the zona pellucida stimulation of adenylyl cyclase activity, while the basal or forskolin-induced activation of the enzyme is not affected. Partial inhibition of the stimulatory effect of the zona pellucida on the adenylyl cyclase activity is observed with guanosine-5'- β -thiodiphosphate (GDP β S), another G protein antagonist. To a reconstitution system containing Lubrol-PX, where zona pellucida or GTP γ S stimulation of the sperm enzyme is not observed, addition of G protein betagamma subunits restores the activation of the sperm adenylyl cyclase by the zona pellucida and GTP γ S without affecting the enzyme activity under basal or forskolin-stimulated conditions. These results support our hypothesis that mouse sperm adenylyl cyclase is stimulated by the zona pellucida through a pertussis toxin-sensitive pathway involving G proteins of the G_i class.

This Article

- ▶ [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 Leclerc, P.](#)
- ▶ [Articles by Kopf, G. S.](#)
- ▶ [Search for Related Content](#)

PubMed

- ▶ [PubMed Citation](#)
- ▶ [Articles by Leclerc, P.](#)
- ▶ [Articles by Kopf, G. S.](#)

This article has been cited by other articles:



MOLECULAR ENDOCRINOLOGY

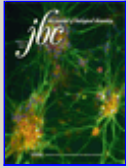
[▶ HOME](#)

G. Livera, F. Xie, M. A. Garcia, B. Jaiswal, J. Chen, E. Law, D. R. Storm, and M. Conti

Inactivation of the Mouse Adenylyl Cyclase 3 Gene Disrupts Male Fertility and Spermatozoon Function

Mol. Endocrinol., May 1, 2005; 19(5): 1277 - 1290.

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



JBC Online

[▶ HOME](#)

M. Spehr, K. Schwane, J. A. Riffell, J. Barbour, R. K. Zimmer, E. M. Neuhaus, and H. Hatt

Particulate Adenylate Cyclase Plays a Key Role in Human Sperm Olfactory Receptor-mediated Chemotaxis

J. Biol. Chem., September 17, 2004; 279(38): 40194 - 40203.

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



Molecular Human Reproduction

[▶ HOME](#)

L. R. Fraser, S. A. Adeoya-Osiguwa, and R. W. Baxendale

First messenger regulation of capacitation via G protein-coupled mechanisms: a tale of serendipity and discovery

Mol. Hum. Reprod., December 1, 2003; 9(12): 739 - 748.

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



BIOLOGY of REPRODUCTION

[▶ HOME](#)

Y.Y. Yuan, W.Y. Chen, Q.X. Shi, L.Z. Mao, S.Q. Yu, X. Fang, and E.R.S. Roldan

Zona Pellucida Induces Activation of Phospholipase A2 During Acrosomal Exocytosis in Guinea Pig Spermatozoa

Biol Reprod, March 1, 2003; 68(3): 904 - 913.

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

[HOME](#) [HELP](#) [FEEDBACK](#) [SUBSCRIPTIONS](#) [ARCHIVE](#) [SEARCH](#) [TABLE OF CONTENTS](#)

Copyright © 1999 by The American Society of Andrology.