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JOURNAL ARTICLE

Evidence for cross-talk between Sertoli and germ cells using selected cathepsins as markers

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To examine whether proteases are possibly involved in cellular migration and/or spermiation when developing germ cells translocate across the seminiferous epithelium during spermatogenesis, in situ hybridization was used to localize messenger RNA (mRNA) transcripts of cathepsin L, D, and S in the epithelium at different stages of the spermatogenic cycle in the rat. Cathepsin L mRNA was found to localize almost exclusively near the basal lamina of the epithelium. At stages VI and VII of the cycle before spermiation, the signal of cathepsin L mRNA was so intense that it formed a complete dark precipitate near the basal lamina encircling the entire tubule. At stage VIII, the expression of cathepsin L was completely abolished, and no staining of cathepsin L mRNA was seen in the epithelium. The mRNA of cathepsin D and S was found near the basal lamina, a finding consistent with their localization in Sertoli cells and possibly primary spermatocytes in almost all stages, but peaked at stages VII-IX and VII-VIII of the cycle, respectively, at the time before and during spermiation. These results illustrate the possible involvement of these proteases in facilitating germ cell movement and spermiation. To examine whether germ cells express any of these cathepsin genes, spermatocytes with a purity of greater than 95% were isolated from 15-day-old rat testes by Percoll gradient centrifugation for reverse transcriptase-polymerase chain reaction. It was found that primary spermatocytes expressed multiple cathepsin genes, including cathepsin B, C, D, H, L, and S. Furthermore, the expression of cathepsin L by germ cells isolated from 15-day-old rats (largely spermatocytes and spermatogonia) can be stimulated by Sertoli cell-enriched culture medium in a dose-dependent manner, but not by germ cell-conditioned medium. These results reveal that germ cell function can be regulated by Sertoli cells. Moreover, these results suggest that germ cells may play an active role in the overall testicular protease expression. Also, we present evidence suggesting there is cross-talk between Sertoli and germ cells, since the expression of cathepsin L in each cell type is regulated by one another via either soluble factors or cell-cell contact.

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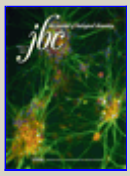

JBC Online HOME

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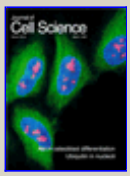

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[Abstract] [Full Text] [PDF]

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[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

W.-Y. Lui, D. D. Mruk, W. M. Lee, and C. Y. Cheng
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C. Y. Cheng and D. D. Mruk
Cell Junction Dynamics in the Testis: Sertoli-Germ Cell Interactions and Male Contraceptive Development
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X.D. Gong, J.C.H. Li, G.P.H. Leung, K.H. Cheung, and P.Y.D. Wong
A BKCa to Kv Switch During Spermatogenesis in the Rat Seminiferous Tubules
Biol Reprod, July 1, 2002; 67(1): 46 - 54.
[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

A. Eriksson, V. Tohonen, A. Wedell, and K. Nordqvist
Isolation of the human testatin gene and analysis in patients with abnormal gonadal development
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[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

C. E. Hirst, M. S. Buzza, V. R. Sutton, J. A. Trapani, K. L. Loveland, and P. I. Bird
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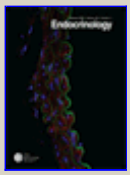
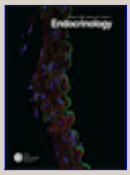


Endocrinology HOME

S. D. Zabludoff, M. Charron, J. N. DeCerbo, N. Simukova, and W. W. Wright
Male Germ Cells Regulate Transcription of the Cathepsin L Gene by Rat Sertoli Cells
Endocrinology, June 1, 2001; 142(6): 2318 - 2327.
[Abstract] [Full Text] [PDF]

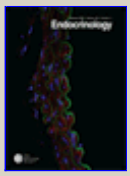


Endocrinology HOME

N. P. Y. Chung and C. Y. Cheng
Is Cadmium Chloride-Induced Inter-Sertoli Tight Junction Permeability Barrier Disruption a Suitable in Vitro Model to Study the Events of Junction Disassembly during Spermatogenesis in the Rat Testis?
Endocrinology, May 1, 2001; 142(5): 1878 - 1888.
[Abstract] [Full Text]

BIOLOGY *of* REPRODUCTION HOME

L. M. Grønning, J. E. Wang, A. H. Ree, T. B. Haugen, K. Taskén, and K. A. Taskén
Regulation of Tissue Inhibitor of Metalloproteinases-1 in Rat Sertoli Cells: Induction by Germ Cell Residual Bodies, Interleukin-1{alpha}, and Second Messengers
Biol Reprod, April 1, 2000; 62(4): 1040 - 1046.
[Abstract] [Full Text]



Endocrinology HOME

E. T. Samy, J. C. H. Li, J. Grima, W. M. Lee, B. Silvestrini, and C. Y. Cheng
Sertoli Cell Prostaglandin D2 Synthetase Is a Multifunctional Molecule: Its Expression and Regulation
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[Abstract] [Full Text] [PDF]

JBC Online HOME

D. D. Mruk and C. Y. Cheng
Sertolin Is a Novel Gene Marker of Cell-Cell Interactions in the Rat Testis
J. Biol. Chem., September 17, 1999; 274(38): 27056 - 27068.
[Abstract] [Full Text] [PDF]