Journal of Andrology, Vol 15, Issue 6 551-557, Copyright © 1994 by The American Society of Andrology

JOURNAL ARTICLE

Age-related decreased Leydig cell testosterone production in the brown Norway rat

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Previous studies have demonstrated that Leydig cell testosterone production diminishes with age in Brown Norway rats. The objective of the studies presented herein was to test the following possible explanations for age-related decline in steroidogenesis: (1) decline in Leydig cell number; (2) understimulation by luteinizing hormone (LH); (3) reduced ability of individual Leydig cells to produce testosterone; and (4) influence of loss of germ cells. Leydig cells isolated from the testes of young and aged rats by centrifugal elutriation and Percoll density gradient centrifugation were examined for their ability to produce testosterone when stimulated maximally with LH or with dibutyryl cyclic AMP (dbcAMP). Leydig cell number and volume were examined in situ using stereological methods. Serum LH levels were measured using a highly sensitive immunofluorometric assay. Average Leydig cell volume decreased with age, and consistent with this observation, individual Leydig cells isolated from aging rats produced significantly less testosterone than those from young rats whether the cells were cultured in vitro with maximally stimulating LH or with dbcAMP. The age-associated diminished testosterone production could not be explained by changes in Leydig cell number, serum LH levels, Leydig cell responsiveness to LH, or testicular germ cell content. These results, taken together, suggest that the reduced testosterone production seen in aged rats is related to defects in the steroidogenic pathway beyond the LH receptor-cAMP cascade. The nature of the initial age-related changes that cause reduced steroidogenesis is not known, and therefore it is not known whether such changes are intrinsic or extrinsic to the Leydig cells.

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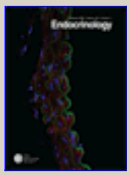

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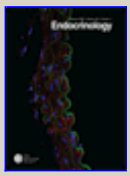
Endocrinology, May 1, 2008; 149(5): 2612 - 2619.
[Abstract] [Full Text] [PDF]



Endocrinology HOME

H. Chen, L. Luo, J. Liu, and B. R. Zirkin
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[Abstract] [Full Text] [PDF]

SAGE KE Science Science of Aging Knowledge Environment HOME

J. L. Carrington and F. L. Bellino
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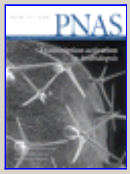
Sci. Aging Knowl. Environ., June 28, 2006; 2006(10): pe17 - pe17.
[Abstract] [Full Text]



Proceedings of the National Academy of Sciences HOME

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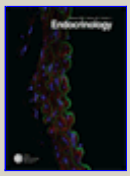
[Abstract] [Full Text] [PDF]

Journal of Andrology HOME

L. Luo, H. Chen, M. A. Trush, M. D. Show, M. D. Anway, and B. R. Zirkin
Aging and the Brown Norway Rat Leydig Cell Antioxidant Defense System
J Androl, March 1, 2006; 27(2): 240 - 247.
[Abstract] [Full Text] [PDF]

Journal of Andrology HOME

L. Luo, H. Chen, and B. R. Zirkin
Temporal Relationships Among Testosterone Production, Steroidogenic Acute Regulatory Protein (StAR), and P450 Side-Chain Cleavage Enzyme (P450scc) During Leydig Cell Aging
J Androl, January 1, 2005; 26(1): 25 - 31.
[Abstract] [Full Text] [PDF]



Endocrinology HOME

H. Chen, J. Liu, L. Luo, and B. R. Zirkin
Dibutyryl Cyclic Adenosine Monophosphate Restores the Ability of Aged Leydig Cells to Produce Testosterone at the High Levels Characteristic of Young Cells
Endocrinology, October 1, 2004; 145(10): 4441 - 4446.
[Abstract] [Full Text] [PDF]

Reproduction HOME

M Jara, R Carballada, and P Esponda
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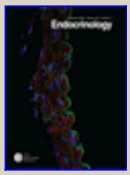
[Abstract] [Full Text] [PDF]

BIOLOGY of REPRODUCTION HOME

G. Rothschild, C. M. Sottas, H. Kissel, V. Agosti, K. Manova, M. P. Hardy, and P. Besmer
A Role for Kit Receptor Signaling in Leydig Cell Steroidogenesis
Biol Reprod, September 1, 2003; 69(3): 925 - 932.
[Abstract] [Full Text] [PDF]

EXPERIMENTAL BIOLOGY AND MEDICINE HOME

M.A. Ottinger, K. Kubakawa, M. Kikuchi, N. Thompson, and S. Ishii
Effects of Exogenous Testosterone on Testicular Luteinizing Hormone and Follicle-Stimulating Hormone Receptors During Aging
Experimental Biology and Medicine, October 1, 2002; 227(9): 830 - 836.
[Abstract] [Full Text] [PDF]



Endocrinology HOME

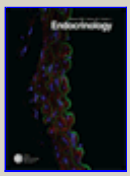
H. Chen, M. P. Hardy, and B. R. Zirkin
Age-Related Decreases in Leydig Cell Testosterone Production Are Not Restored by Exposure to LH in Vitro
Endocrinology, May 1, 2002; 143(5): 1637 - 1642.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

M. Culty, L. Luo, Z.-X. Yao, H. Chen, V. Papadopoulos, and B. R. Zirkin
Cholesterol Transport, Peripheral Benzodiazepine Receptor, and Steroidogenesis in Aging Leydig Cells
J Androl, May 1, 2002; 23(3): 439 - 447.
[Abstract] [Full Text] [PDF]

BIOLOGY of REPRODUCTION HOME

I.-s. Kim, H.B. Siril Ariyaratne, and S.M.L. C. Mendis-Handagama
Changes in the Testis Interstitium of Brown Norway Rats with Aging and Effects of Luteinizing and Thyroid Hormones on the Aged Testes in Enhancing the Steroidogenic Potential
Biol Reprod, May 1, 2002; 66(5): 1359 - 1366.
[Abstract] [Full Text] [PDF]



Endocrinology HOME

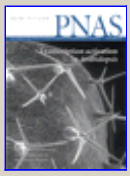
P. Syntin, H. Chen, B. R. Zirkin, and B. Robaire
Gene Expression in Brown Norway Rat Leydig Cells: Effects of Age and of Age-Related Germ Cell Loss
Endocrinology, December 1, 2001; 142(12): 5277 - 5285.
[Abstract] [Full Text] [PDF]

BIOLOGY *of* REPRODUCTION HOME

B. R. Zirkin and H. Chen
Regulation of Leydig Cell Steroidogenic Function During Aging
Biol Reprod, October 1, 2000; 63(4): 977 - 981.
[Abstract] [Full Text]

BIOLOGY *of* REPRODUCTION HOME

K.N. Wolf, D.E. Wildt, A. Vargas, P.E. Marinari, J.S. Kreeger, M.A. Ottinger, and J.G. Howard
Age-Dependent Changes in Sperm Production, Semen Quality, and Testicular Volume in the Black-Footed Ferret (Mustela nigripes)
Biol Reprod, July 1, 2000; 63(1): 179 - 187.
[Abstract] [Full Text]



Proceedings of the National Academy of Sciences HOME

H. Chen and B. R. Zirkin
Long-term suppression of Leydig cell steroidogenesis prevents Leydig cell aging
PNAS, December 21, 1999; 96(26): 14877 - 14881.
[Abstract] [Full Text] [PDF]

BIOLOGY *of* REPRODUCTION HOME

S. Levy and B. Robaire
Segment-Specific Changes with Age in the Expression of Junctional Proteins and the Permeability of the Blood-Epididymis Barrier in Rats
Biol Reprod, June 1, 1999; 60(6): 1392 - 1401.
[Abstract] [Full Text]
