Adult mice and LH-responsive MA-10 Leydig cells exhibit exogenous cholesterol acquisition signaling.

Hiroshi Takahashi*

Department of Diabetes and Endocrinology, Nara Medical University, 840 Shijou-cho, Kashiihara, Nara, 634-8521, Japan

Abstract

Here, we review key findings about the function and control of Leydig cells that have been made over a long period of time. The high quantities of androgen (testosterone or androstenedione, depending on the species) produced by foetal Leydig cells are essential for the masculinization of the brain and the differentiation of male genitalia. With the death of these cells, androgen production decreases, peaking postpartum.

Keywords: Exogenous cholesterol, Leydig cells.

Introduction

The growth of adult Leydig cells from stem cells causes testosterone to gradually rise to high levels. Luteinizing Hormone (LH) binding to Leydig cell LH receptors increases the rate of cholesterol translocation into the mitochondria in adults by promoting the synthesis of cAMP. The CYP11A1 enzyme at the inner mitochondrial membrane converts cholesterol to pregnenolone, and pregnenolone is converted to testosterone by mitochondria and smooth endoplasmic reticulum enzymes. A protein complex made up of the cholesterol binding translocator protein, voltage-dependent anion channels, other mitochondrial and cytosolic proteins, and generated at mitochondrial contact sites mediates cholesterol translocation to the inner mitochondrial membrane [1].

Writing this review article, Leydig Cells: Formation, Function and Regulation, for the Biology of Reproduction Special Issue honouring the 50th anniversary of the formation of the Society for the Study of Reproduction is a pleasure and an honour for us (SSR). Among the many researchers who have contributed to our current understanding of Leydig cells, there have been a number of significant figures in the SSR. Our goal in this overview is to highlight significant advancements throughout the years that have helped us understand how Leydig cells function and are regulated, as well as how this knowledge is helping us treat diseases that cause low serum levels of testosterone. We regret that we have only been able to mention a small number of the many exceptional researchers whose work has made a substantial contribution to this crucial topic. We briefly describe the review's content in this introduction. Sections below include details (and the majority of sources) [2].

Franz von Leydig, a German naturalist and anatomist, first identified the existence of interstitial cells in the testes of many mammals in 1850, sparking the start of studies on Leydig cells. Fifty years later, Bouin and Ancel made the initial claim that the interstitial Leydig cells are the source of androgens. Baillie proved that these cells have the enzyme 3-hydroxysteroid dehydrogenase almost 60 years later. Around the same period, research by Hall and Eik-Nes, Ewing and Eik-Nes, and others demonstrated that pituitary gonadotropic hormones encourage the production of androgen by the testes both in vitro and ex vivo. In 1969, Hall and others provided evidence that the interstitial Leydig cells were the site of testosterone synthesis from cholesterol. As a result, it took almost a century from the discovery of interstitial cells in 1850 to appreciate the major steps involved in Leydig cell function.

We now understand that males produce androgen in two unique timeframes the foetal and adult periods as well as two distinct populations of Leydig cells that produce androgen the foetal and adult Leydig cells. High quantities of androgen (testosterone or androstenedione, depending on the species) produced by foetal Leydig cells are necessary for the masculinization of the brain as well as the differentiating of the male genitalia. As the number of foetal Leydig cells decreases postnatally, testosterone production also decreases, reaching a low point early in the postpartum period. The subsequent growth of adult Leydig cells from neonatal testis stem cells causes testosterone to gradually rise to high levels. Adult Leydig cells seldom ever divide or die after they are formed [3].

Leydig Cells

The expression of the foetal hormones Anti-Mullerian Hormone (AMH), secreted by foetal Sertoli cells, and androgen and INSL3, generated by foetal Leydig cells, determines the male phenotype in part. AMH causes the Müllerian ducts to

***Correspondence to:** Hiroshi Takahashi, Department of Diabetes and Endocrinology, Nara Medical University, 840 Shijou-cho, Kashiihara, Nara, 634-8521, Japan, E-mail: takahashi.h@nmu.edu.jp

***Received:** 28-Jul-2022, Manuscript No. AAJCER-22-118; **Editor assigned:** 30-Jul-2022, Pre QC No. AAJCER-22-118(PQ); **Reviewed:** 13-Aug -2022, QC No. AAJCER-22-118; **Revised:** 22-Aug-2022, Manuscript No. AAJCER-22-118(R); **Published:** 29-Aug-2022, DOI: 10.35841/aajcer-5.4.118*

***Citation:** Takahashi H. Adult mice and LH-responsive MA-10 Leydig cells exhibit exogenous cholesterol acquisition signaling. J Clin Endocrinol Res. 2022;5(4):118*

recede, and androgen causes the Wolffian ducts to differentiate into male reproductive organs. The foetal Leydig cells in mice are produced by cells expressing steroidogenic factor 1 (SF-1; NR5A1). Platelet-derived growth factor A and desert hedgehog encourage the development of the SF-1-expressing cells into foetal Leydig cells. Although the foetal Leydig cells themselves are not mitotically active, their number rises significantly during embryonic development, indicating that progenitor cells must differentiate into new cells rather than existing foetal Leydig cells dividing [4].

By gestational day 15.5, the foetal Leydig cells in rats start to make testosterone; this production peaks just before delivery. The foetal Sertoli cells in the mouse convert androstenedione into testosterone after the foetal Leydig cells make it [5].

Conclusion

LH is initially not necessary for the growth of foetal Leydig cells or the synthesis of their androgen. But later, LHR is expressed and the foetal Leydig cells react to LH stimulation. The regression of foetal Leydig cells starts in the late stages of foetal life and continues afterward, despite the fact that plasma LH levels are still high at the end of gestation. Even as adults, some foetal Leydig cells do survive. It is doubtful that these cells have a major impact on how much testosterone is produced in an adult. The finding that the genes expressed by foetal and adult Leydig cells differ suggests that the two cell populations develop and operate differently.

References

1. Le Minor JM, Sick H. About the 350th anniversary of the foundation of the chair of anatomy of the faculty of medicine at Strasbourg (1652-2002). Histoire des Sciences Medicales. 2003;37(1):31-40.
2. Baillie AH. Observations on the growth and histochemistry of the Leydig tissue in the postnatal prepubertal mouse testis. J Anat. 1961;95(3):357.
3. Hall PF, Eik-Nes KB. The action of gonadotropic hormones upon rabbit testis in vitro. Biochim Biophys Acta. 1962;63(3):411-22.
4. Ewing LL, Eik-Nes KB. On the formation of testosterone by the perfused rabbit testis. Can J Biochem. 1966;44(10):1327-44.
5. Hall PF, Irby DC, De Kretser DM. Conversion of cholesterol to androgens by rat testes: comparison of interstitial cells and seminiferous tubules. Endocrinol. 1969;84(3):488-96.

Citation: *Takahashi H. Adult mice and LH-responsive MA-10 Leydig cells exhibit exogenous cholesterol acquisition signaling. J Clin Endocrinol Res. 2022;5(4):118*