

Role of peroxisome proliferator-activated receptors (PPARs) and free fatty acid receptors (FFARs) in androgen-dependent regulation of metabolic functions of rodent testicular cells.

The main factor regulating the production of male germ cells, sperm cells, in the testes is the hormonal environment, in particular the sex hormones androgens. Androgens control metabolic functions of the somatic cells of the testes, Sertoli and Leydig cells, which are crucial for male fertility. These hormones are responsible i.a. for regulating the production of energy substances necessary for the development of germ cells. However, the molecular mechanisms involved in androgen-dependent regulation of these processes remain unclear. Due to the lack of full knowledge about the mechanisms controlling the function of male gonads, it is often impossible to diagnose the causes of male fertility problems, and consequently it is also difficult to select an appropriate treatment method. Previous studies have revealed the role of peroxisome proliferator-activated receptors (PPARs) and free fatty acid receptors (FFARs) in the regulation of cellular glucose and lipid metabolism, but the role of androgens in controlling the function of these receptors in male gonadal cells has not yet been studied.

The research hypothesis of this project assumes that in somatic cells of rodent testes there are interactions between androgens and signaling pathways involving PPAR and/or FFAR receptors, which play an important role in the regulation of key functions of these cells. The main goal of the project is to demonstrate how androgens influence PPAR and FFAR pathways activity in rodent testes and to explain the importance of this relationship in the regulation of Sertoli and Leydig cell metabolisms.

The research planned in this project will be carried out with the use of model animals (rats) and cell cultures. In the first phase of research, androgen-regulated components of PPAR and FFAR signaling will be identified. For this purpose, the action of androgens will be pharmacologically blocked in male rats. Next, the molecular mechanisms involved in the regulation of the PPAR and FFAR pathways in Sertoli and Leydig cells will be investigated using cell cultures. The last step of the research will explain the effects of interactions between androgens and the PPARs and/or FFARs on glucose and lipid metabolism in Sertoli and Leydig cells.

The obtained results will contribute to broadening the knowledge about the molecular mechanisms involved in the control of key processes for male fertility, such as the production by Sertoli cells the energy substances for germ cells and the synthesis of sex hormones by Leydig cells. The proposed project will be of general importance in the field of biology, and the results obtained will indicate the direction of further research on the function of male gonads. Given that disturbances in androgen signaling and PPAR signaling pathways lead to numerous abnormalities in testes function, causing decreased fertility or infertility, the results of the proposed studies may have clinical significance in diagnostics and may contribute to the development of new therapeutic methods.