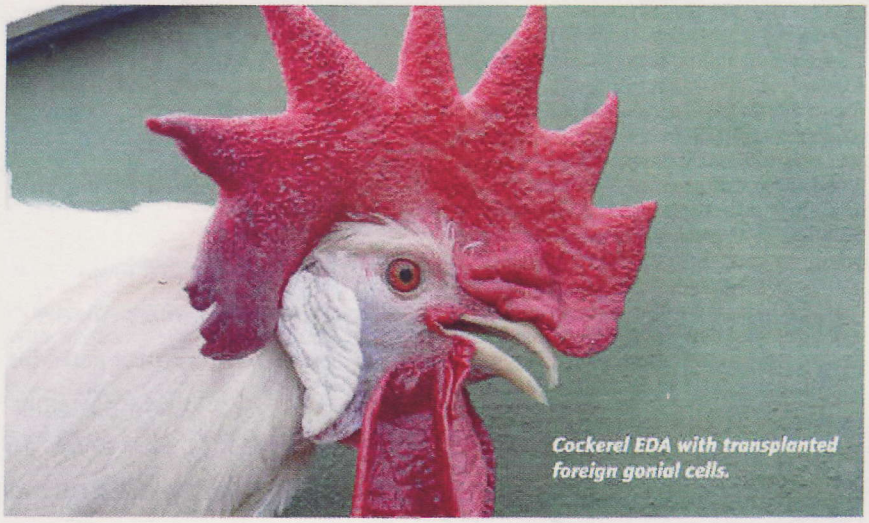
Chickens bred from burrowed spermatozoa

Scientists around the world are continually searching for methods to genetically improve existing commercial strains and to reproduce the best ones quickly and efficiently. Today, both traditional and new methods are used. Transplanting specific cells in the testes of an infertile cockerel creates new opportunities for specific spermatozoa production.



Cockerel EDA with transplanted foreign gonial cells.

For the first time in history an international team of researchers managed to successfully transplant chicken specific cells in the testes of a cockerel to produce cell specific spermatozoa. The team included scientists from BIOPHARM, Research Institute of Biopharmacy and Veterinary drugs, a.s., from Jílové near Prague (Dr Pavel Trefil, leader of the research group), scientists from the Institute of Molecular Biology from AV ČR (Dr Jiří Hejnar, leader of the group), as well as Murray Bakst (USDA, Belstsville, USA) and Jean Pierre Brillard (INRA, Nouzilly, Fr). The results of their work were published in the scientific journal 'Biology of Reproduction'.

The success of this unique work is demonstrated by the living cockerel named EDA. At first sight he looks like a common White leghorn breed, however, his spermatozoa originated from burrowed Black minor (BM) cells, which have the black colour phenotype.

The mouse was first

"Burrowing" of spermatozoa was done for the first time in 1994 by American scientist Ralph Brinster from the University of Pennsylvania. He conducted experiments with the transfer of testicular cells between two male mice. With the use of specific drug treatment he "killed" all spermatogonial cells of the acceptor male mouse and then injected gonial cells collected from testes of the donor male into these sterile testes. Dr Brinster was also successful in the interspecific rat to mouse gonial cells transplantation resulting in the mouse producing rat spermatozoa.

Transplantation of chicken gonial cells was a very difficult task mainly due to the intra-abdominal position of avian testes, which require a complex surgical operation. Dr Trefil and his team developed a method to create EDA. Before the transplantation, this cockerel had to undergo repeated irradiation treatments to completely eradicate its gonial cells to make him infertile. The cockerel was later injected with specific gonial cells (removed from Black minor cockerel) into its sterile testes expecting them to recolonise in their new environment. The transplantation was successful and resulted in spermatozoa production within several weeks. Fertility test with BM hens showed the spermatozoa to be of good quality. Although the spermatozoa were produced by the white cockerel, EDA's hatched chickens had a black colour, similar to BM x BM crossing.

A new bioreactor

The success of this work has opened the door for efficient genetic modification of the transplanted cells, especially to spermatogonias, says Dr Trefil. He believes that it offers a new approach to the chicken transgenesis, which is so far reduced only to the embryo manipulation. Results of his work are also promising for using chickens as live bioreactors for the production of important pharmaceutical proteins. Many of these proteins are commonly produced by bacteria fermentation, but this method has its limitations where the production and quality of more complicated molecules is concerned. Therefore, the described model appears to be promising for future genetic work, as well as the production of specific proteins. ■