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Development of an innovative technology using transgenic porcine tissues for biomedical purposes

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Statement of the Problem: The growing shortage of available organs is a major problem in transplantology. The promising solution could be xenotransplantation, i.e., the use of cells, tissues and organs of domestic pig. However, xenogeneic transplantation from pigs to humans involves high immune incompatibility and a complex rejection process. The rapid development of genetic engineering techniques enables genome modifications in pigs that reduce the cross-species immune barrier. The purpose of this study is to develop the technology to use transgenic pigs for biomedical purposes. The project is an alternative to studies using stem cells and work aiming at the production of artificial organs.

Methodology & Theoretical Orientation: Development of an animal breeding system and the collection of skin, valves and blood vessels from transgenic pigs. The project involves also production of polytransgenic pigs using reproduction biotechnology methods. Very important was development and characteristics of gene constructs preventing xenotransplant rejection and multiparametric characteristics of transgenic animals. Tissues of transgenic animals were used for treatment of human cardiovascular diseases using vessels and cardiac valve bioprostheses. Biological dressings were obtained from skin of transgenic pigs.

Findings: Important issues in production of transgenic animals are characteristics of transgene, transfection and cell transformation, detection of transgene integration, mapping of transgene, passing specific traits to the offspring, homozygote selection, analysis of transgene activity and function. Fully characterized transgenic animals carrying three or more modifications may be used as sources of skin, heart valves or vessels.

Conclusion & Significance: Transgenic animals were generated using traditional methods and new genome editing technologies. Tissues of transgenic animals used in experimental studies showed growing potential in use as alternative treatment of human.

Biography

Ryszard Slomski is the Head of the Department of Biochemistry and Biotechnology at Poznan University of Life Sciences and Professor at Institute of Human Genetics of the Polish Academy of Sciences in Poznan. His main research focus on preparation of gene constructs containing human genes for expression in animal cells, including large animals and preparation of other gene constructs in prokaryotic and eukaryotic systems; characteristics of novel human, animal and plant genes; paternity and relationship testing based on DNA studies; molecular diagnostics of Duchenne muscular dystrophy (DMD), familial polyposis of the colon (FAP), thyroid cancer and Crohn's disease. He is involved in development of an innovative technology of biomedical applications for tissues of transgenic pigs, acronym MEDPIG and development of cannabinoid collection technology from hemp with low THC content as means of treatment of pain in cancer patients, acronym ONKOKAN.

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