24TH Biotechnology Congress: Research & Innovations
&
Annual Congress on
CRISPR Cas9 Technology and Genetic Engineering
October 24-25, 2018 | Boston, USA

Generation of genetically modified ducks by CRISPR/Cas9-mediated gene insertion into the duck genome

Svitlana Kostenko[1,2,5], Oksana Konoval [1,3], Pavlo Tabaka[1,3], Lizhi Lu[1], Petro Korol[4], Alona Chepiha[2], Mariia Doroshenko[2], Xingchen Bu[1], Lingling Huang[1], Xuetao Huang[5], Liumeng Li[5]

[1]Zhejiang Academy of Agricultural Sciences (Hangzhou, China)

[2]National University of Life and Environmental Sciences of Ukraine, Ukraine

[3]Ukrainian Laboratory of Quality and Safety of Agricultural Products of National University of Life and Environmental Sciences of Ukraine (Chabany, Ukraine)

[4]Institute of Animal Breeding and Genetics nd. a. M.V. Zubets NAAS of Ukraine (Tchoubynske, Ukraine)

[5]Zhuji Guowey Poultry Development Co, Ltd (Zhuji, China)

Statement of the Problem: The bird egg is a potential bioreactor for heterologous production of protein, especially for the production of recombinant therapeutic proteins in the biopharmaceutical industry. The vast majority for the last 30 years of studies on the transgenic poultry focus on chickens (Gallus gallus) and quails (Coturnix japonica). Since duck (Anas platyrhynchos) eggs are larger than chicken and quail eggs, they have an advantage of being used as bioreactors over chickens and quails. The limiting factor of widespread distribution of genetic modification technologies in poultry, especially in waterfowl, is often the high cost of generating transgenic birds primarily due to the relatively low efficiency of transgenesis.

Methodology & Theoretical Orientation: We used CRISPR/Cas9-mediated homology-directed repair to edit the duck genome. Three different approaches were used to deliver the transgene into the host genome: lipofectamine transfection of sperms followed by artificial fertilization; microinjection of transfected blastoderm cells into duck blastoderm-stage embryos; direct injection of the transgene into the cavity under the germinal disc of duck embryos.

Findings: In the approach of sperm-mediated gene transfer, 20.6% of the founder ducks were positive for the transgene. In the other two approaches, 65% and 77.8% chimeric founders transmitted the transgene to the next generation. Transgene transmission to the next generation was observed in three different approaches, suggesting an appropriate genome editing. Therefore, we have successfully generated transgenic ducks using all the three approaches. Genome engineering of ducks is significant because it can be used as a model of waterfowl.

This study was supported by the Earmarked Fund for National Waterfowl-industry Technology Research System (CARS-42-06) and the Zhejiang Major Scientific and Technological Project of Agricultural (livestock's) Breeding (grant number 2016C02054-12).

Biography

Professor of the Department of Genetics, Breeding and Biotechnology of Animals of the National University of Life and Environmental Science of Ukraine, Doctor of Biological Sciences (in genetics) theoretically substantiated and experimentally demonstrated the species-specific destabilization of karyotype of different species of animals under the influence of chronic low-dose irradiation (Kostenko SA, 2001). Scientific interest is currently associated with increasing the efficiency of introducing transgenic structures into the genome of waterfowl and creating new lines of ducks based on the polymorphism of the genes of quantitative traits. International expert of the company Zhejiang Generation Biological Science and Technology Co., Ltd.

svitlanakasijan@ukr.net

Notes: